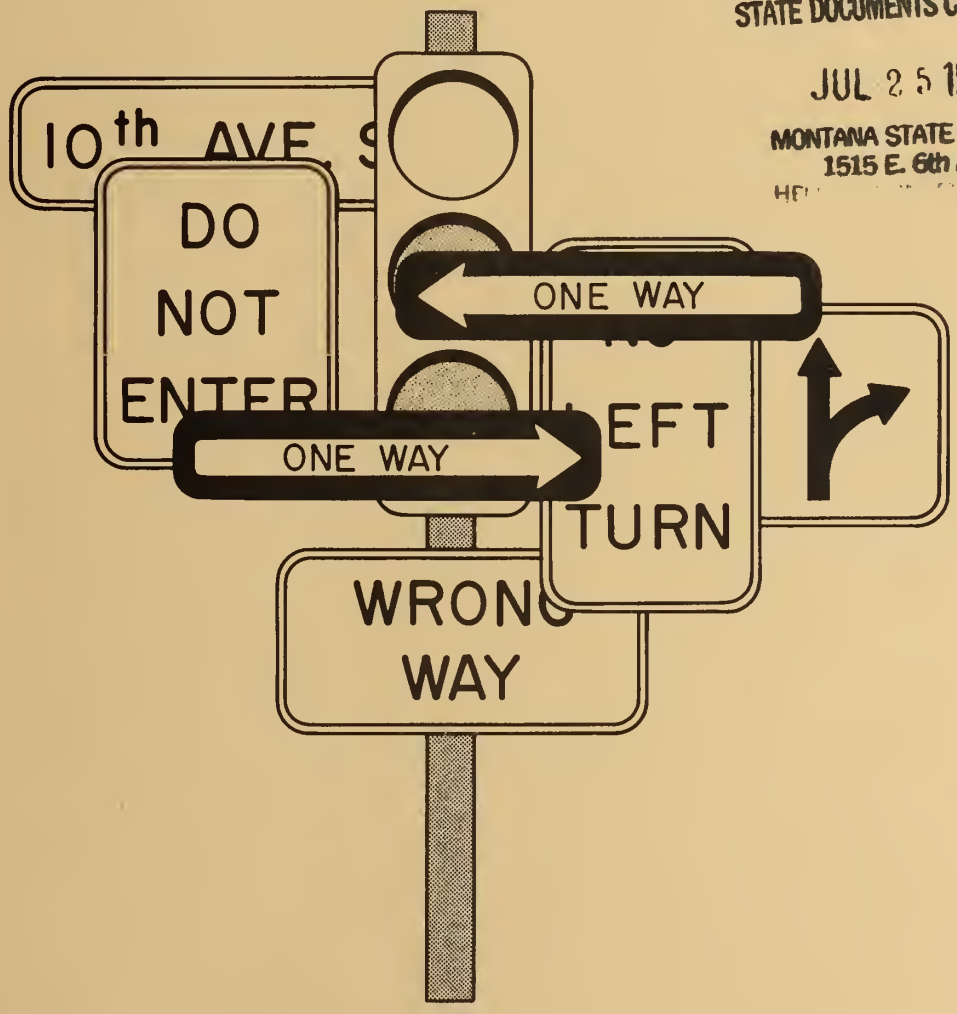
Great Falls, Montana
— 10th AVENUE SOUTH —

IMPROVEMENT PLAN

·TECHNICAL SUPPLEMENT·



PLEASE RETURN

Robert Peccia & Associates
Planners - Engineers - Designers

GREAT FALLS, MONTANA

TENTH AVENUE SOUTH IMPROVEMENT PLAN

TECHNICAL SUPPLEMENT

FOR THE

MONTANA DEPARTMENT OF HIGHWAYS

PLANNING AND RESEARCH BUREAU

In cooperation with the
Department of Transportation
Federal Highway Administration

By:
ROBERT PECCIA & ASSOCIATES
HELENA, MONTANA
March, 1979

TENTH AVENUE SOUTH IMPROVEMENT PLAN - TECHNICAL SUPPLEMENT

INTRODUCTION

The Tenth Avenue South Improvement Plan Report contains a description of the analyses conducted, the recommendations made, and the final improvement plan proposed. Some of the information collected for this plan was considered too detailed to be included in the Improvement Plan Report, but was pertinant to the development of the project.

Some of the detailed computions and support information has been compiled and is contained in reports on file at the Department of Highways - Planning and Research Bureau in Helena. Other information whereby a specific element of the project has been addressed in a separate report paper, or where an independent consultant prepared a report on a specific subject, has been compiled and is contained in this Tenth Avenue South Improvement Plan - Technical Supplement.

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APPENDIX A

GREAT FALLS URBAN TRANSPORTATION PLANNING

GOALS, OBJECTIVES AND SUBOBJECTIVES

APPENDIX A

GREAT FALLS URBAN TRANSPORTATION PLANNING

GOALS, OBJECTIVES, AND SUBOBJECTIVES

As part of the instructions to the Consultant in the development of an Improvement Plan for Tenth Avenue South, the Department of Highways included a set of Goals and Objectives for the study in the contract agreement. These goals and objectives are contained in the "Tenth Avenue South Improvement Plan" report.

In addition to the goals and objectives established by the Department of Highways, the Consultant was also directed to consider the goals, objectives and subobjectives adopted by the Great Falls Transportation Policy Coordinating Committee for Urban Transportation Planning in Great Falls.

These goals, objectives, and subobjectives established by the Policy Coordinating Committee are contained in this section of this Technical Supplement.

GOALS AND POLICY OBJECTIVES

Following an extensive review by the Citizens Advisory and Technical Advisory Committees of the Great Falls Urban Transportation Study, the Policy Coordinating Committee on February 17, 1977, adopted a set of goals, objectives and sub-objectives for urban transportation planning in Great Falls. These goals, objectives and sub-objectives are indicated in Table 1. All transportation planning efforts as well as all decisions made in the course of the transportation planning process are expected to be consistent with these goals, objectives and sub-cbjectives. The Transportation Systems Management element of the urban transportation plan has been prepared with the abovementioned goals, objectives, and sub-objectives in mind. Hopefully, the implementation of the urban transportation plan, including the Transportation Systems Management element, will contribute to the attainment of the urban transportation planning goals, objectives and sub-objectives.

Concurrent with the deliberations of the Citizens Advisory and Technical Advisory Committees regarding urban transportation planning goals and objectives, an organization known as the Citizens Involvement Committee of the City of Great Falls researched the areas of industrial/commercial development and orderly residential growth within the City of Great Falls and prepared a detailed description of goals and policies within these areas. These goals and policies, listed in Table 2, were adopted by the Great Falls City Commission on March 1, 1977. While these goals and policies are in many cases unrelated to the transportation planning effort, it is expected that transportation planning policies and decisions will be consistent with the industrial/commercial and housing goals and policies.

TABLE 1

GREAT FALLS URBAN TRANSPORTATION PLANNING

GOALS, OBJECTIVES AND SUBOBJECTIVES

I. MAXIMIZE MOBILITY OF PEOPLE AND GOODS

A. Minimize Travel Time

1. Maximize convenient travel access and interconnecting route system between all major activity centers
2. Encourage the use of limited access arterials
3. Maximize the future use of bypass arterials around developed sections of the urban area
4. Minimize conflicts between transportation modes
5. Encourage sufficient runway and terminal facilities and services to meet the present and future needs of aviation
6. Provide adequate system capacity
7. Maximize shopper convenience in the central business district and all shopping areas by providing for adequate nearby public or private parking facilities
8. Provide total system continuity

B. Minimize Travel Cost

1. Maximize convenient travel access and interconnecting route system between all major activity centers
2. Explore and encourage practical alternate modes of vehicular transportation

C. Provide Adequate System Safety

1. Minimize conflicts between transportation modes
2. Discourage heavy traffic near playgrounds and parks
3. Encourage the use of limited access arterials
4. In school areas, provide adequate crosswalks, signs, signals, monitors and safety education programs
5. Provide quality system maintenance and modernization

D. Provide Adequate System Reliability

1. Provide quality system maintenance and modernization

II. ENHANCE THE URBAN ENVIRONMENT

A. Provide for Equitable Distribution of Local Accessibility for Employment, Health, Education, Commerce and Recreation

1. Maximize convenient travel access and interconnecting route system between all major activity centers.

B. Foster a Desirable Arrangement of Land Use and Transportation Facilities

1. Encourage future implementation of sound land use concepts
2. Encourage future implementation of beautification projects
3. Monitor possible future use of railroad property and river access for parking and recreation
4. Maximize shopper convenience in the central business district and all shopping areas by providing for adequate nearby public or private parking facilities

C. Minimize Community Disruption

1. Avoid penetration of defined neighborhood and school zones by arterial streets
2. Discourage heavy traffic near playgrounds and parks
3. Maximize the future use of bypass arterials around developed sections of the urban area
4. Encourage future implementation of sound land use concepts

D. Minimize Air, Noise, and Site Pollution

1. Explore and encourage practical alternate modes of vehicular transportation
2. Discourage heavy traffic near playgrounds and parks
3. Avoid penetration of defined neighborhoods and school zones by arterial streets

E. Minimize Transportation System Capital and Operating Costs

1. Minimize local economic impact by taking maximum advantage of available federal, state and private funds

APPENDIX B

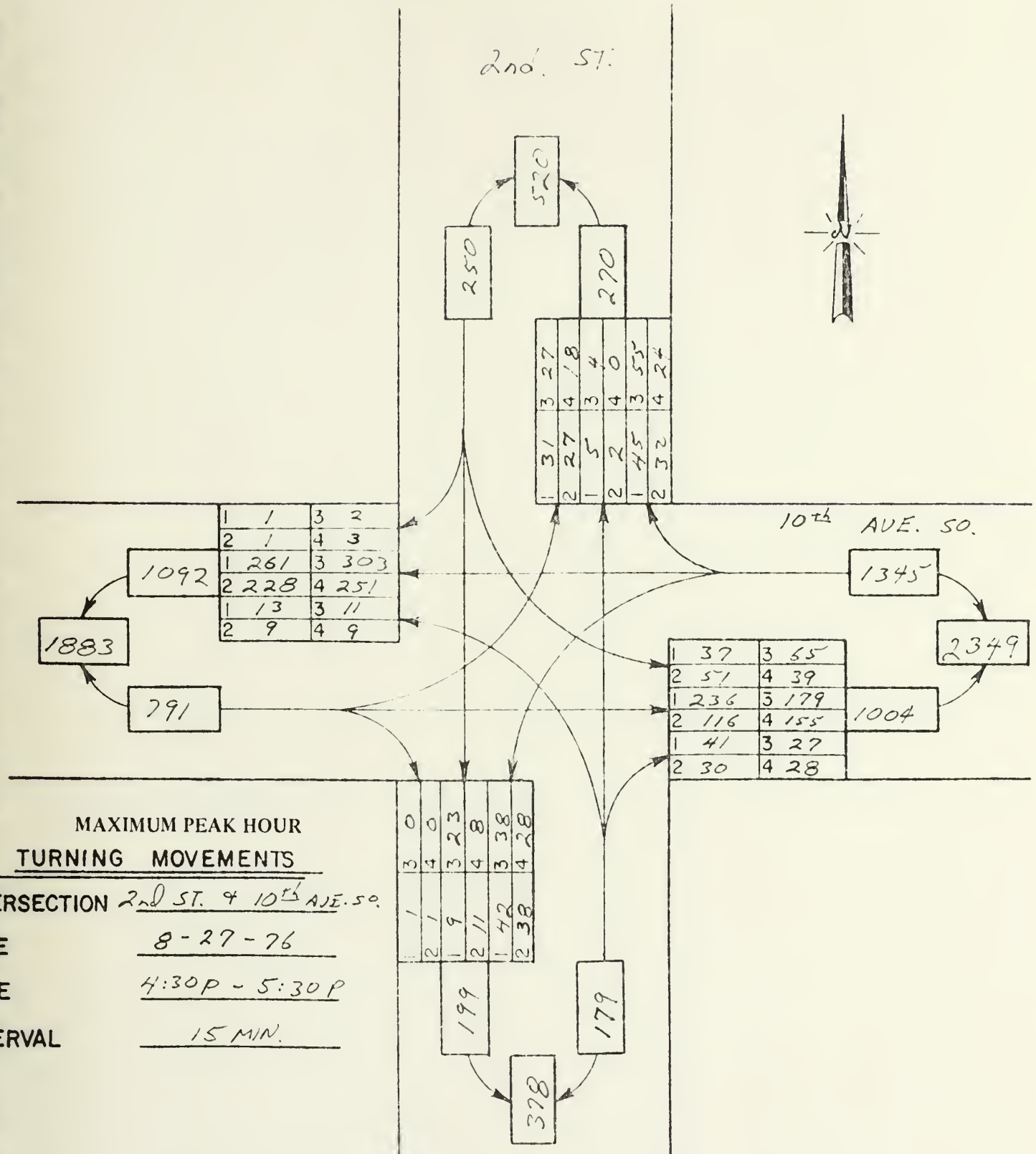
TURNING MOVEMENTS

APPENDIX B

TURNING MOVEMENTS

Traffic turning movement counts were made at all the major intersections along Tenth Avenue South. These counts were made during the morning, noon, and afternoon peak traffic volume periods for most of the intersections. It was determined that the maximum traffic counts generally occurred between 4:30 p.m. and 5:30 p.m.

The detailed traffic counts are contained in a computation report that is held on file in the office of the Planning and Research Bureau at the Department of Highways. However, because of the importance of these traffic counts to the movement of traffic on Tenth Avenue South, the maximum peak hour turning movement counts at each intersection are contained in this Technical Supplement.



MAXIMUM PEAK HOUR

TURNING MOVEMENTS

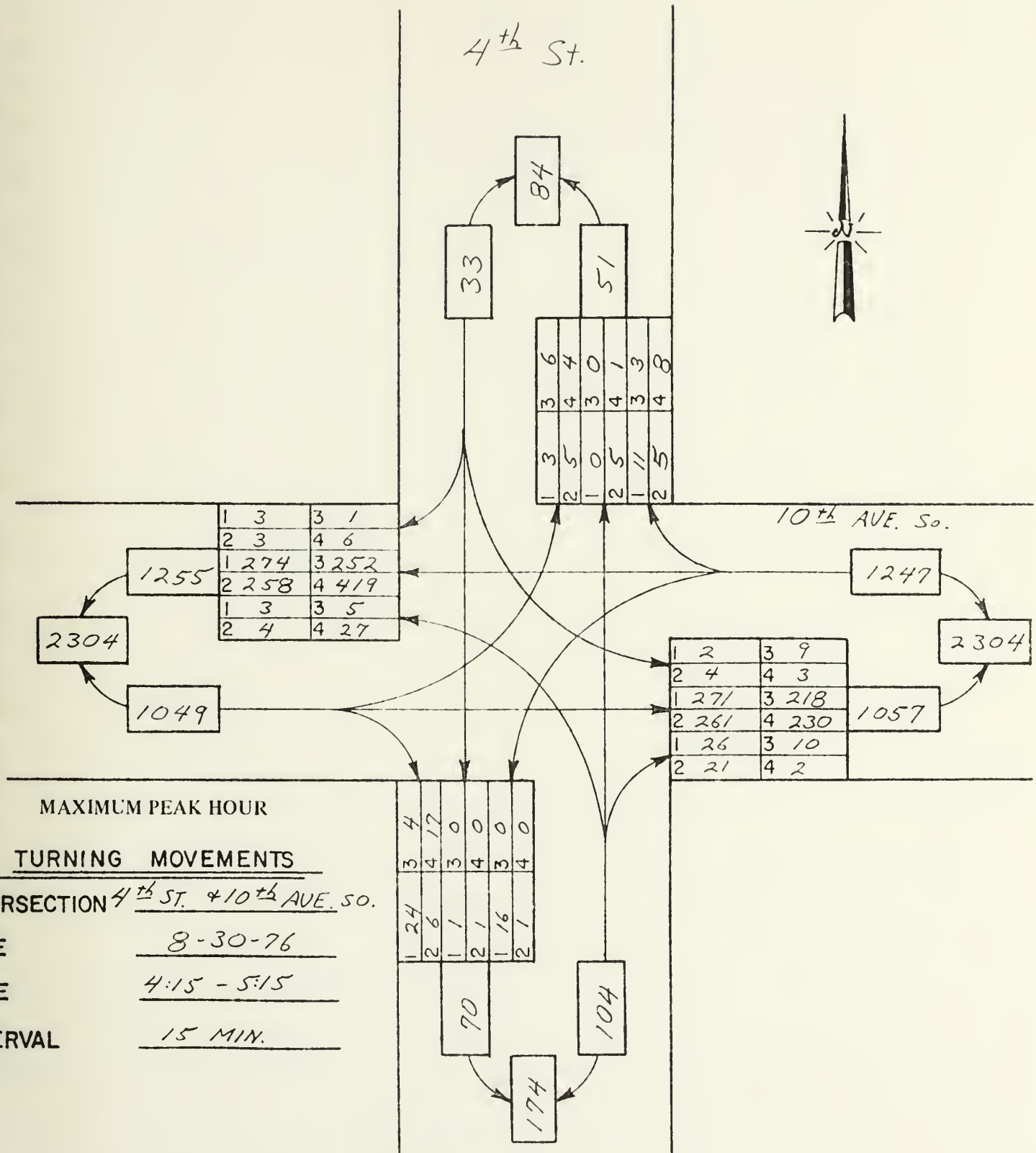
INTERSECTION 2nd ST. & 10th AVE. SO.

TE 8-27-76

TIME 4:30P - 5:30P

TERVAL 15 MIN.

Prepared by:
ROBERT PECCIA & ASSOCIATES
Helena - Havre



MAXIMUM PEAK HOUR

TURNING MOVEMENTS

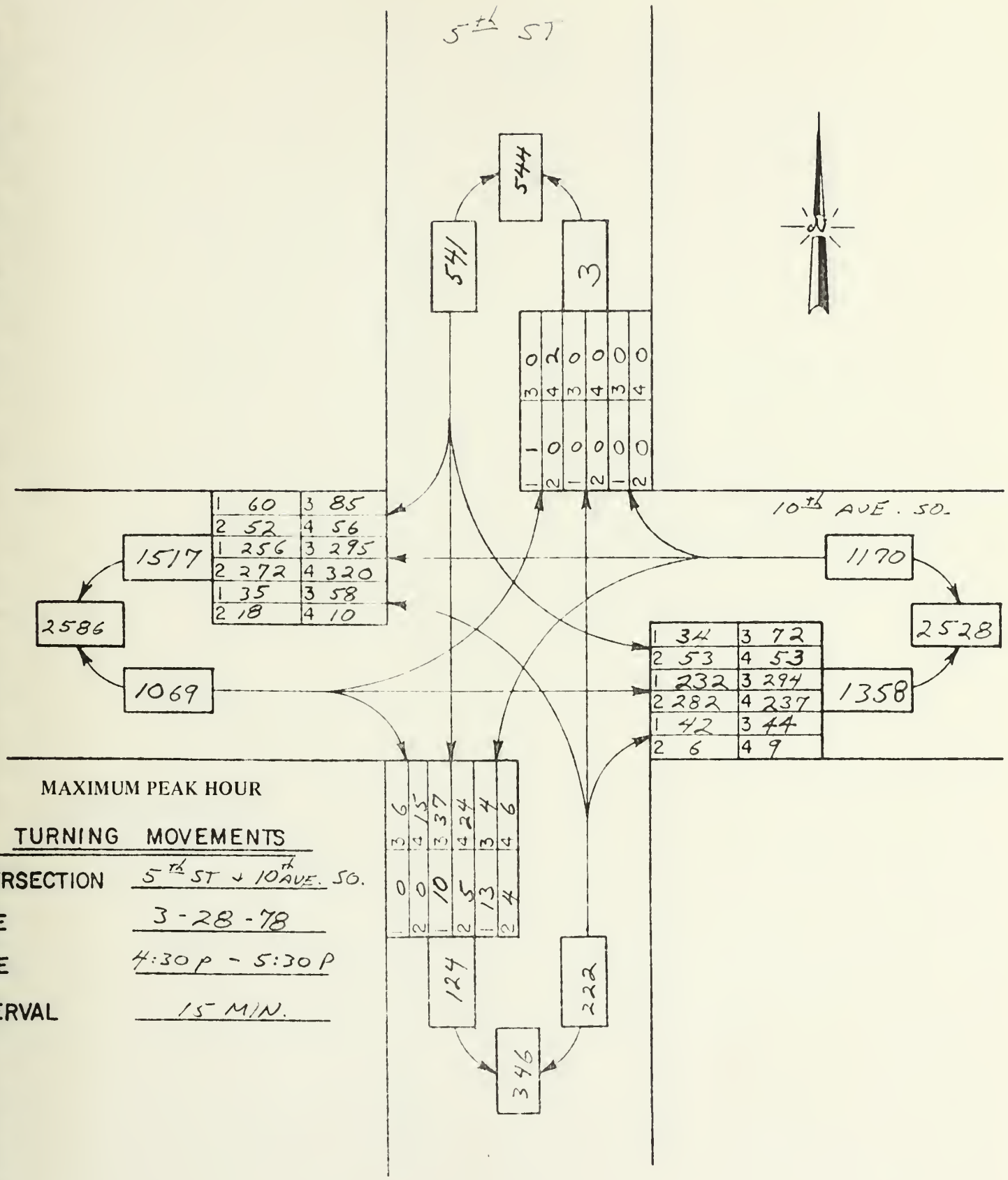
INTERSECTION 4th ST. & 10th AVE. So.

DATE 8-30-76

TIME 4:15 - 5:15

INTERVAL 15 MIN.

Prepared by:
ROBERT PECCIA & ASSOCIATES
Helena - Havre



MAXIMUM PEAK HOUR

TURNING MOVEMENTS

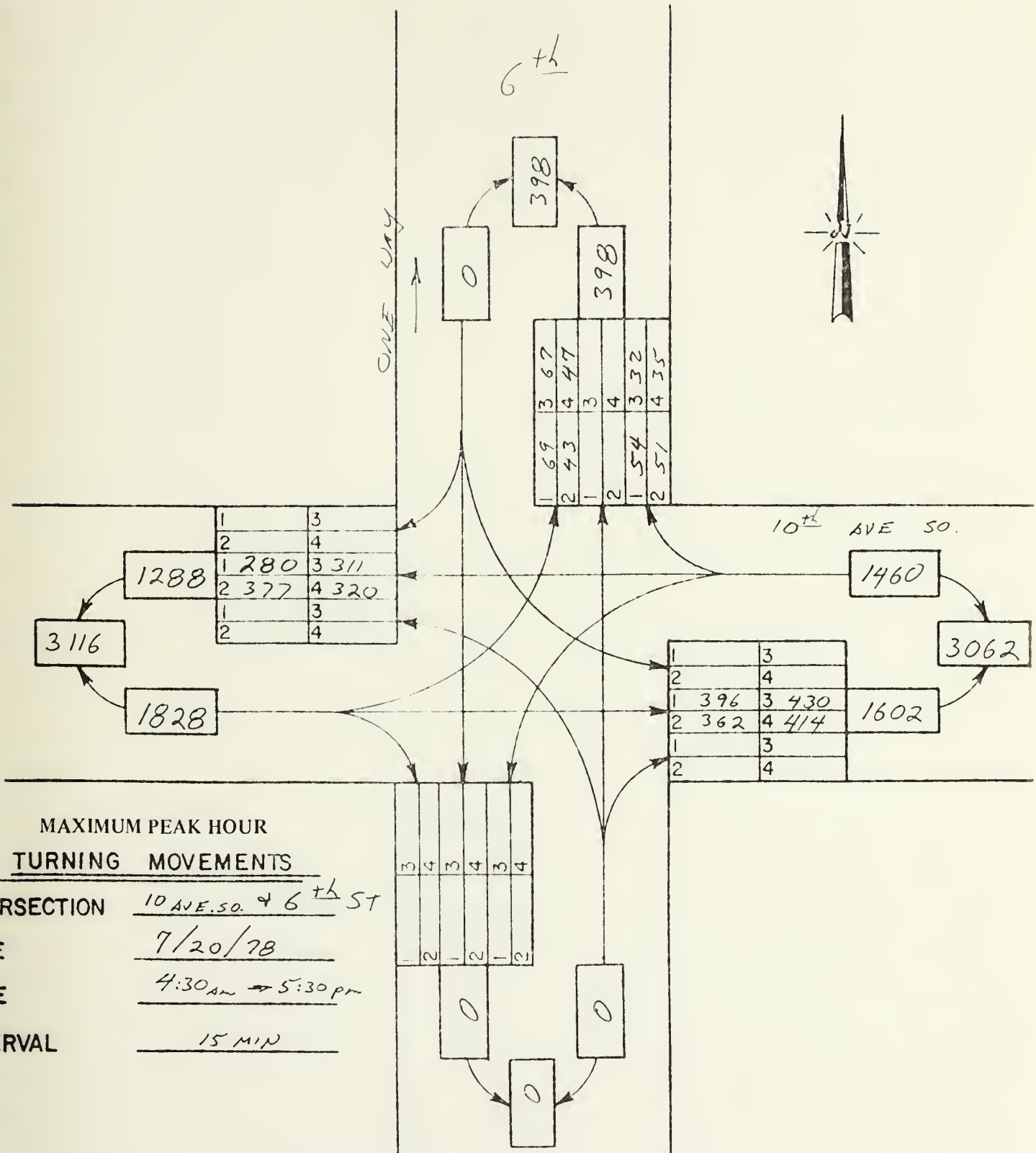
INTERSECTION 5th ST + 10th AVE. SO.

DATE 3-28-78

TIME 4:30 P - 5:30 P

INTERVAL 15 MIN.

Prepared by:
ROBERT PECCIA & ASSOCIATES
Helena - Havre



MAXIMUM PEAK HOUR

TURNING MOVEMENTS

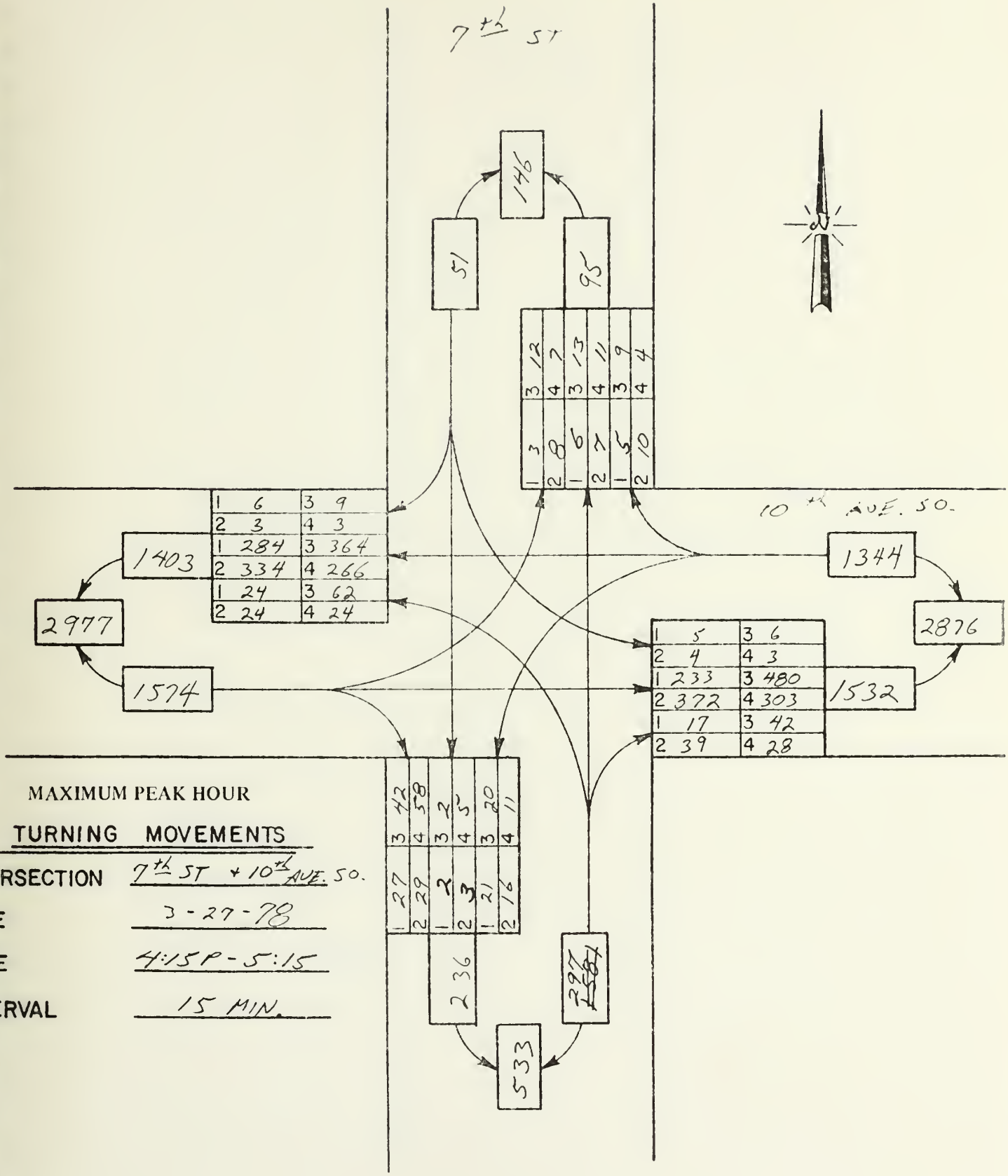
INTERSECTION 10 AVE. SO. & 6th ST

DATE 7/20/78

TIME 4:30 AM → 5:30 PM

INTERVAL 15 MIN

Prepared by:
ROBERT PECCIA & ASSOCIATES
Helena - Havre



MAXIMUM PEAK HOUR

TURNING MOVEMENTS

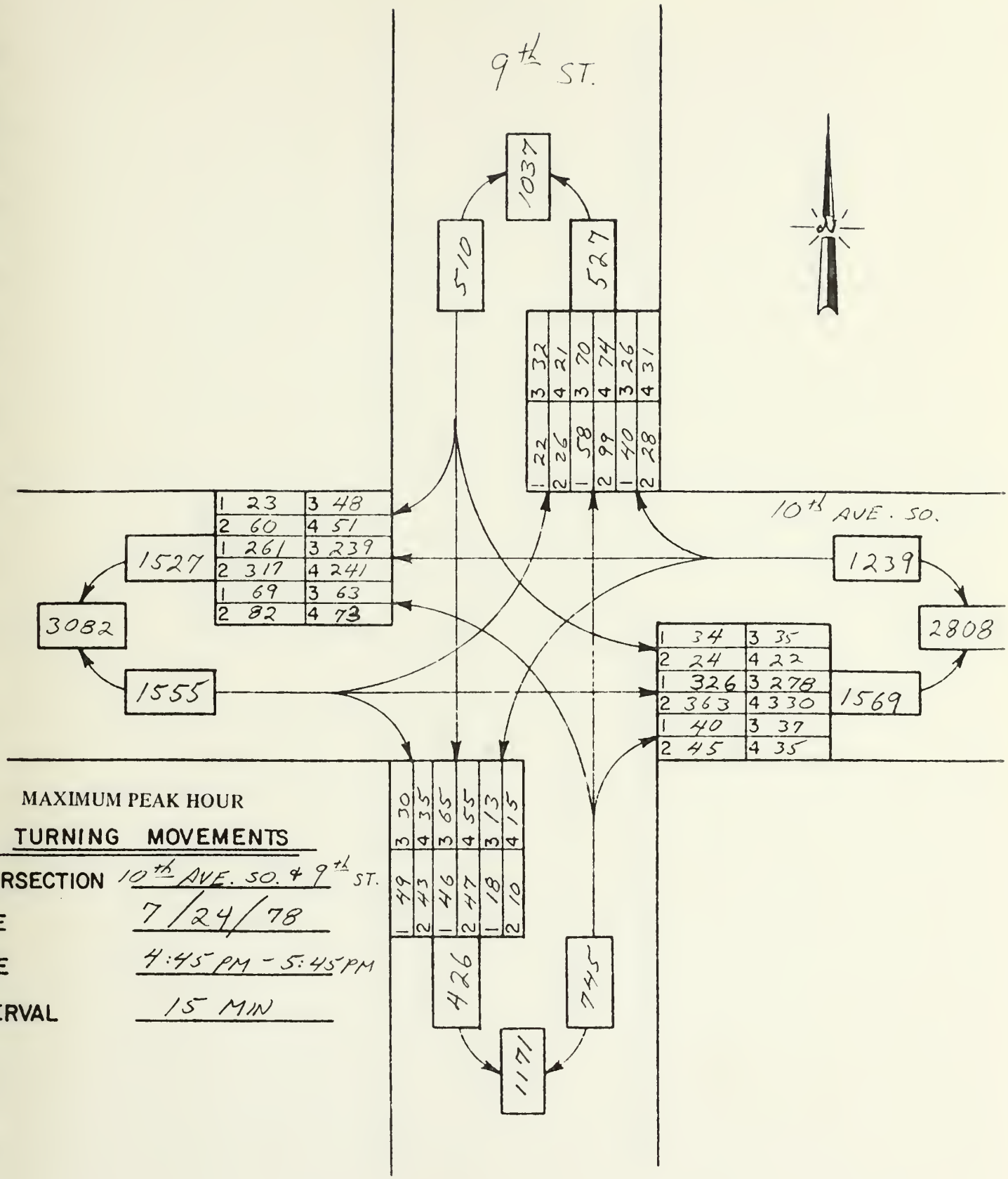
INTERSECTION 7th ST + 10th AVE. SO.

ATE 3-27-78

TIME 4:15P-5:15

NTERVAL 15 MIN.

Prepared by:
ROBERT PECCIA & ASSOCIATES
Helena - Havre



MAXIMUM PEAK HOUR

TURNING MOVEMENTS

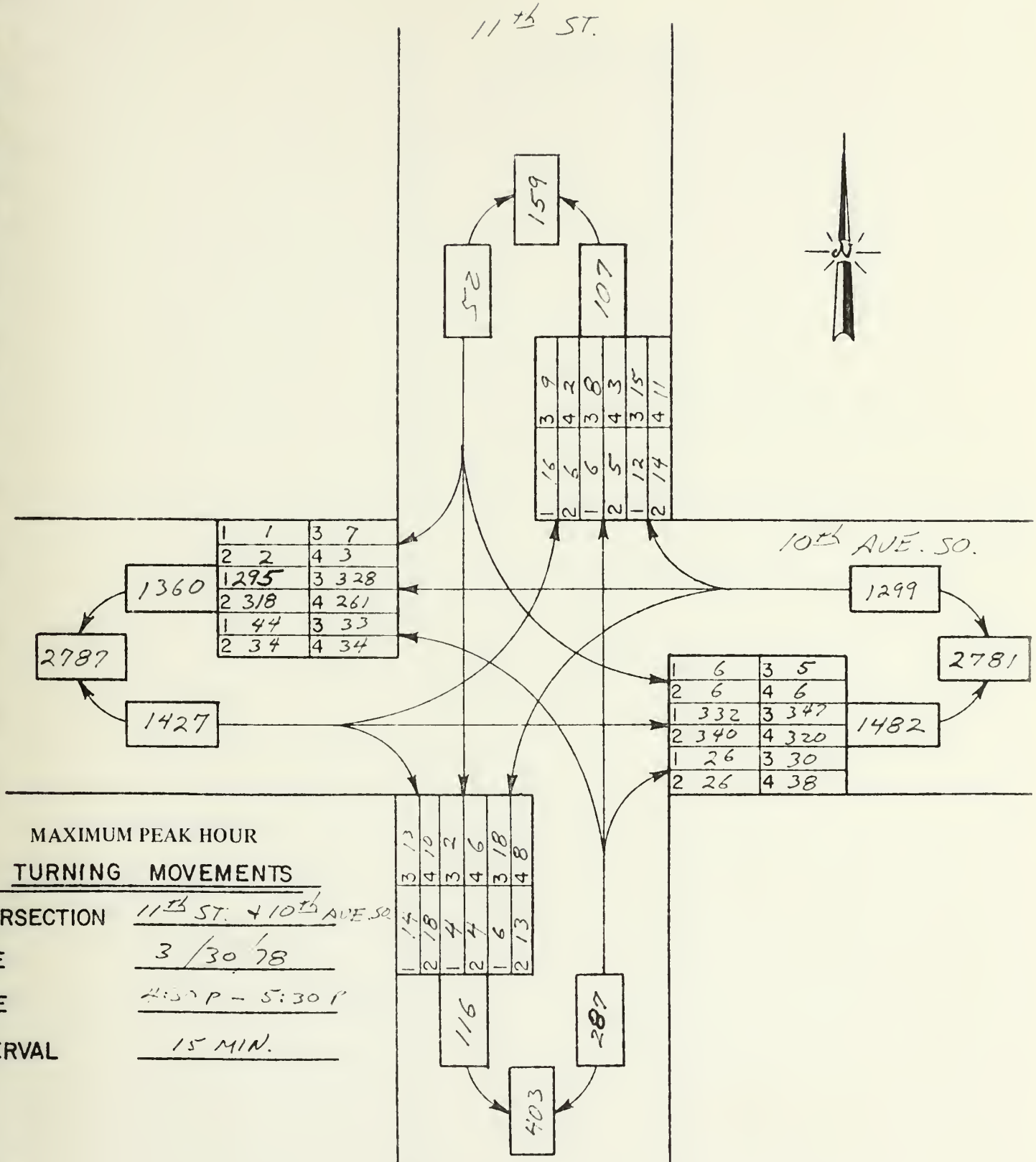
INTERSECTION 10th AVE. SO. & 9th ST.

DATE 7/24/78

TIME 4:45 PM - 5:45 PM

INTERVAL 15 MIN

Prepared by:
ROBERT PECCIA & ASSOCIATES
Helena - Havre



MAXIMUM PEAK HOUR

TURNING MOVEMENTS

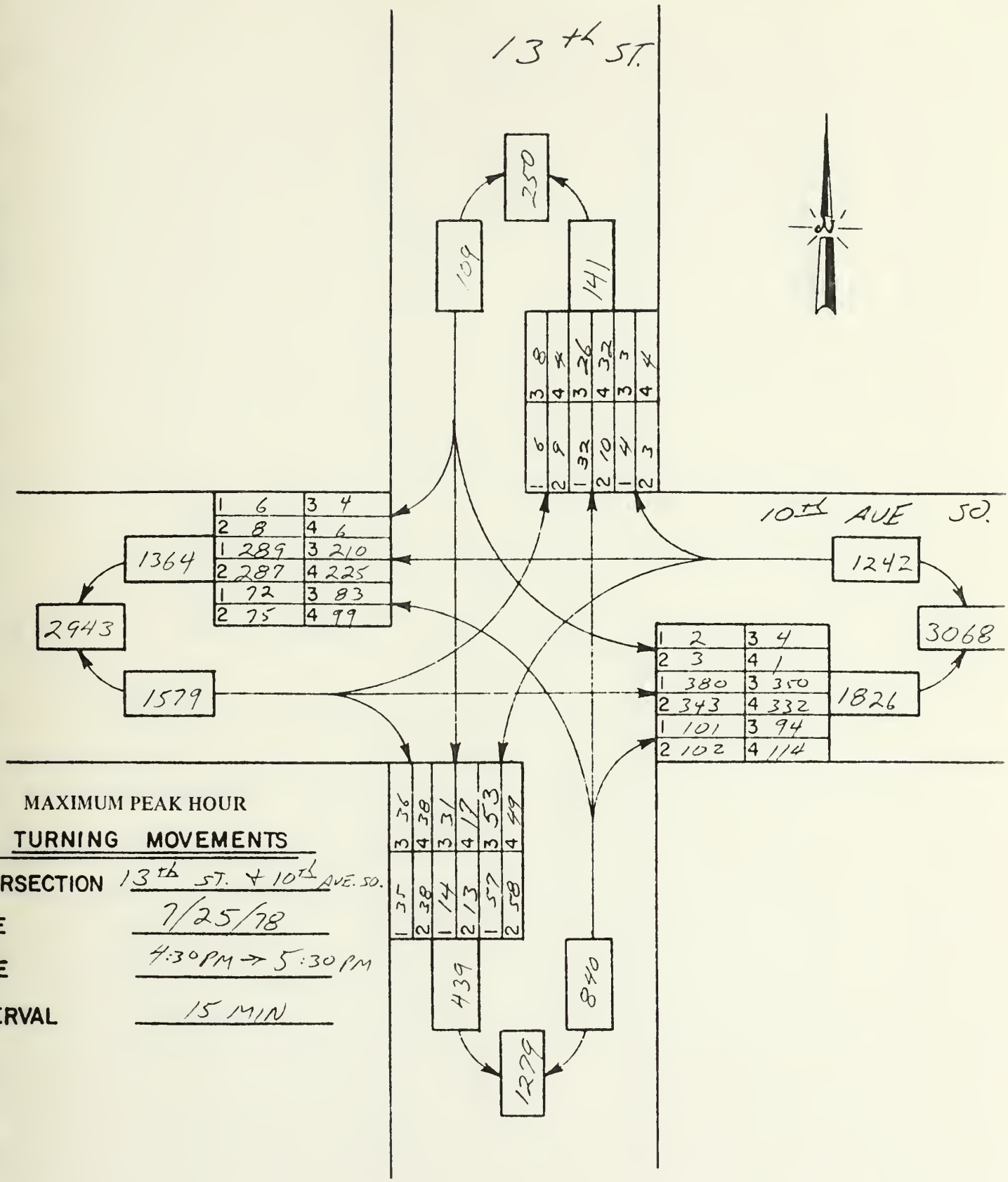
NTERSECTION 11TH ST. & 10TH AVE. SO.

TE 3/30/78

TIME 4:30 P - 5:30 P

NTERVAL 15 MIN.

Prepared by:
ROBERT PECCIA & ASSOCIATES
Helena - Havre



MAXIMUM PEAK HOUR

TURNING MOVEMENTS

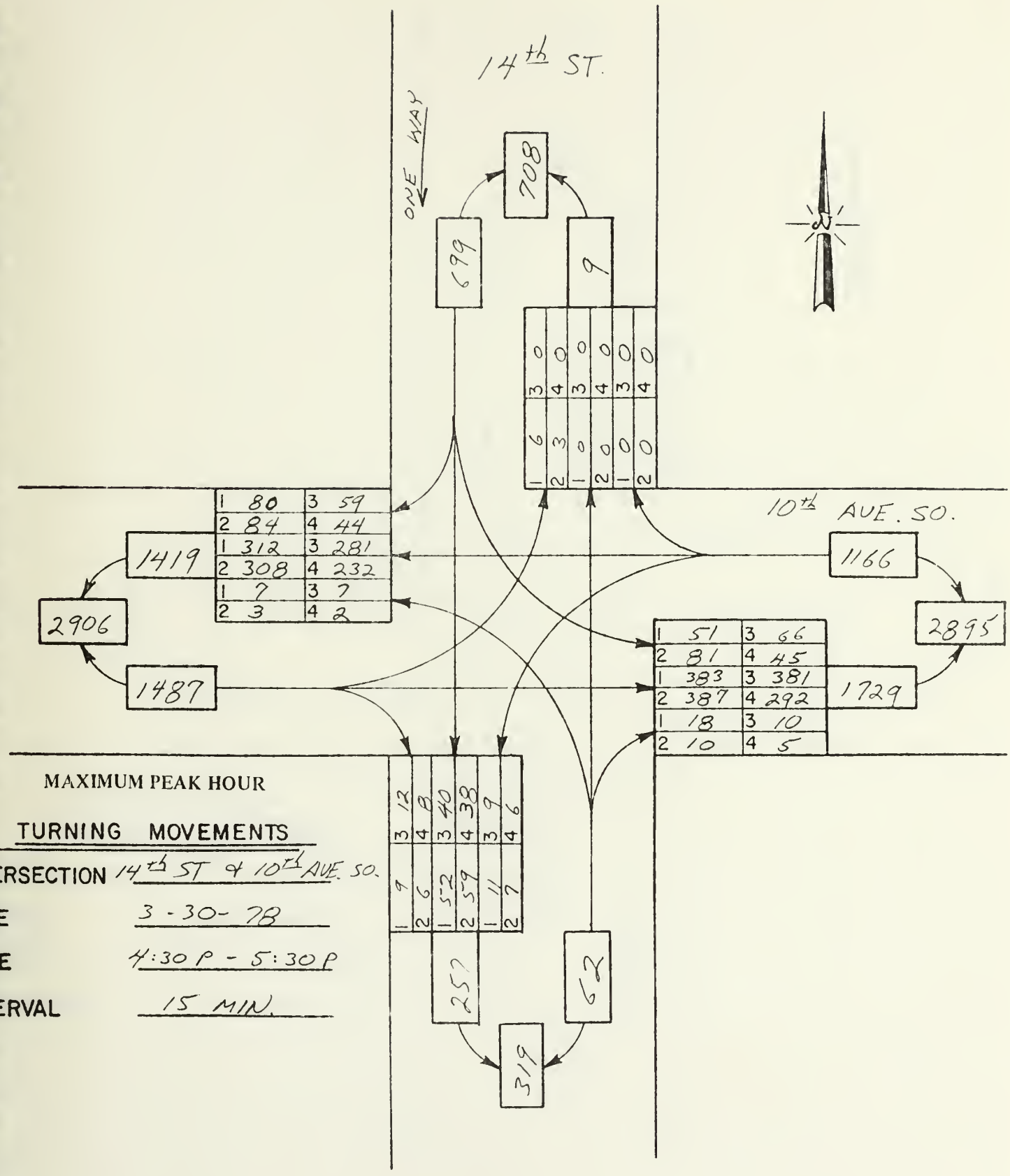
INTERSECTION 13th ST. & 10th AVE. SO.

DATE 7/25/78

TIME 4:30 PM → 5:30 PM

INTERVAL 15 MIN

Prepared by:
ROBERT PECCIA & ASSOCIATES
Helena - Havre



MAXIMUM PEAK HOUR

TURNING MOVEMENTS

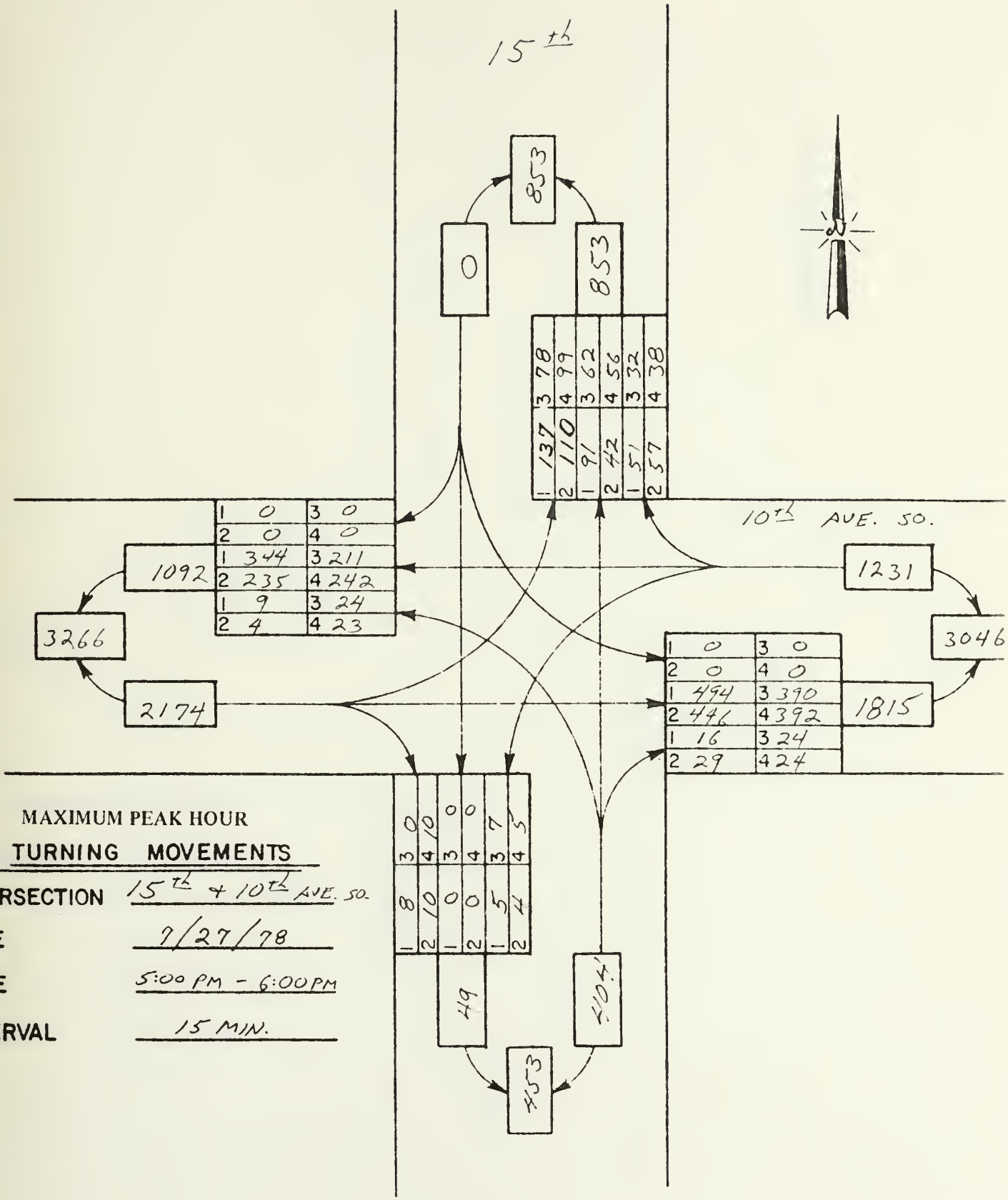
INTERSECTION 14th ST & 10th AVE. SO.

DATE 3-30-78

TIME 4:30 P - 5:30 P

INTERVAL 15 MIN.

Prepared by:
ROBERT PECCIA & ASSOCIATES
Helena - Havre



MAXIMUM PEAK HOUR

TURNING MOVEMENTS

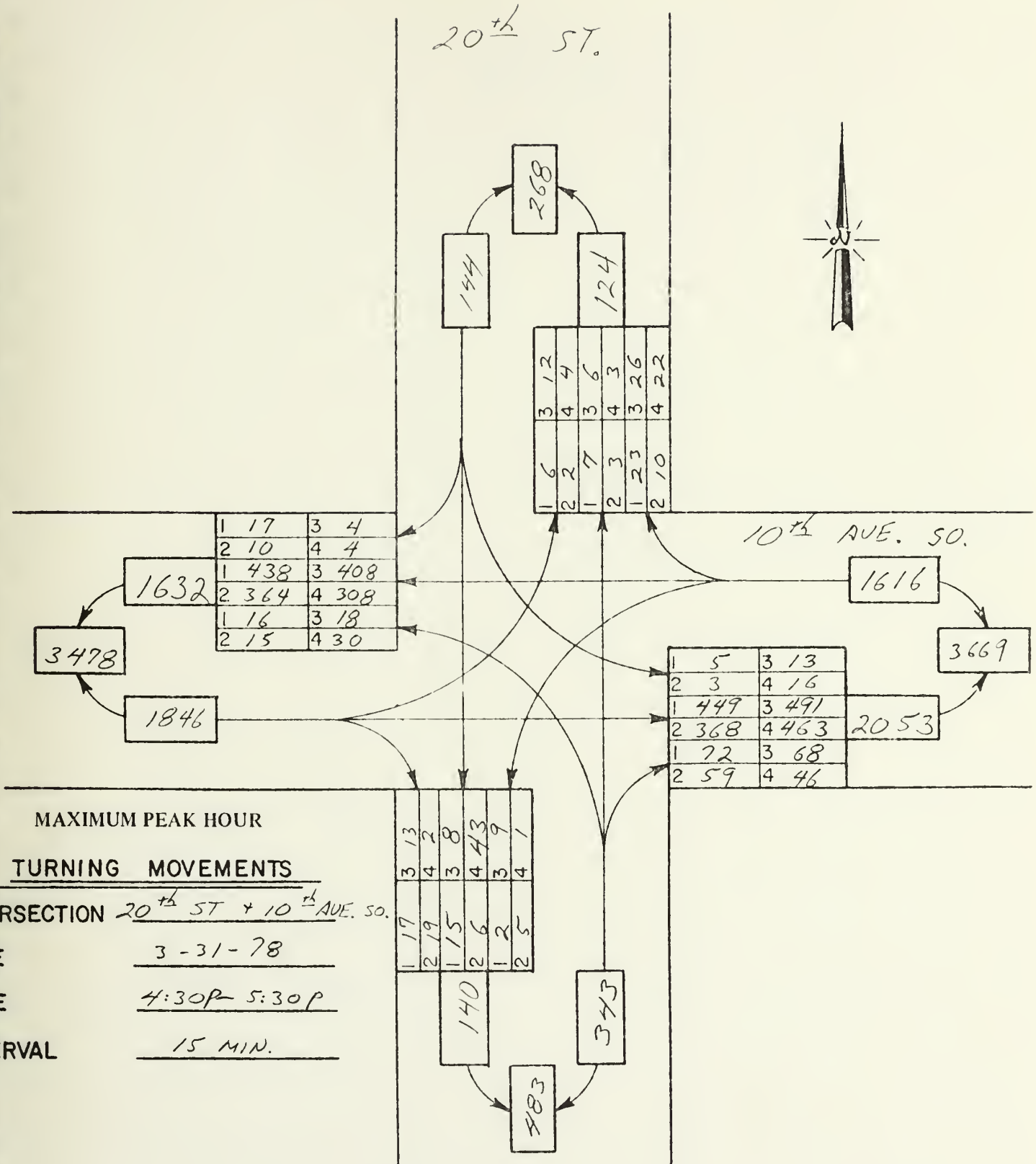
INTERSECTION 15th & 10th AVE. SO.

DATE 9/27/78

TIME 5:00 PM - 6:00 PM

INTERVAL 15 MIN.

Prepared by:
ROBERT PECCIA & ASSOCIATES
Helena - Havre



MAXIMUM PEAK HOUR

TURNING MOVEMENTS

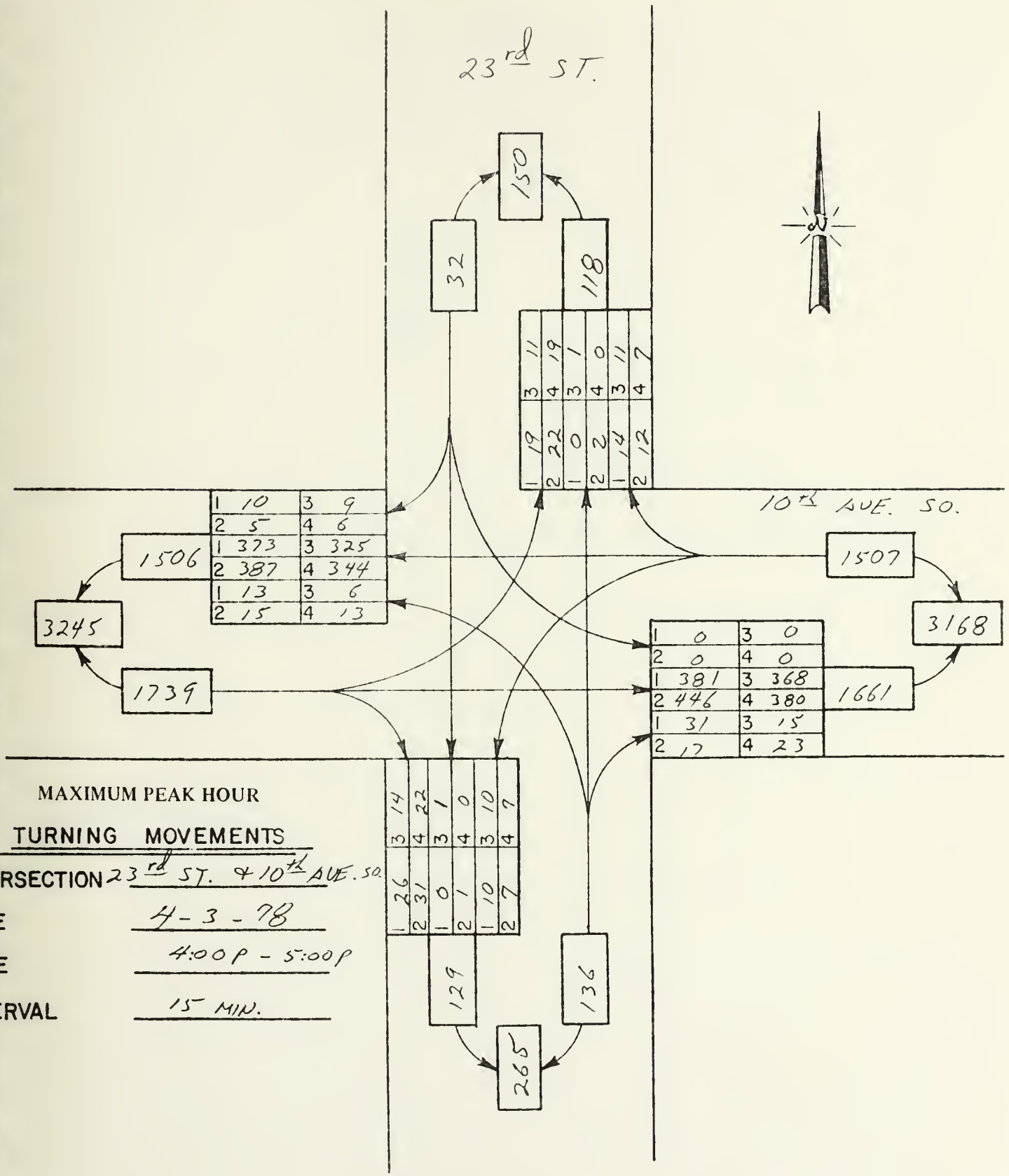
INTERSECTION 20th ST + 10th AVE. SO.

DATE 3-31-78

TIME 4:30p - 5:30p

INTERVAL 15 MIN.

Prepared by:
ROBERT PECCIA & ASSOCIATES
Helena - Havre



MAXIMUM PEAK HOUR

TURNING MOVEMENTS

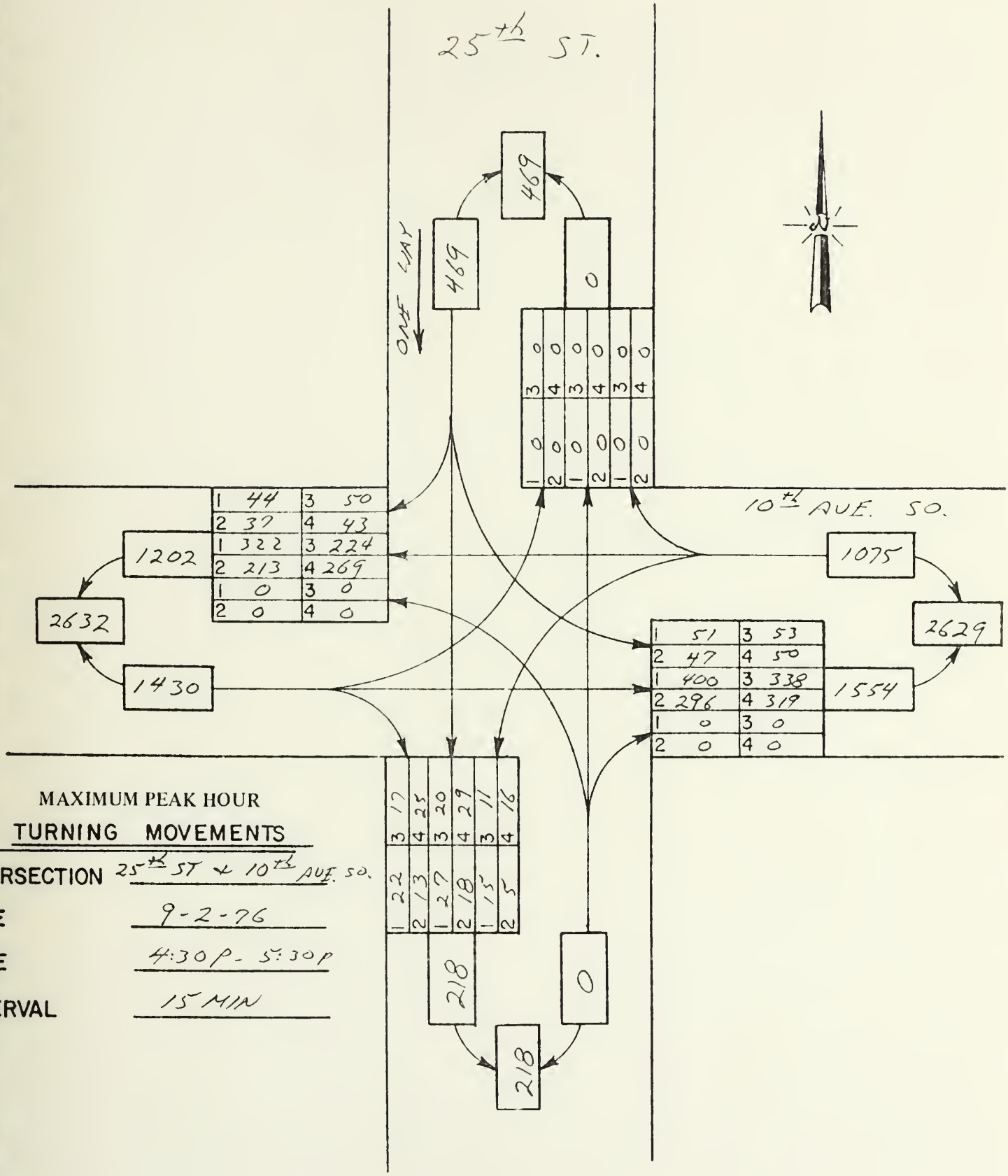
INTERSECTION 23rd ST. & 10th AVE. SO.

DATE 4-3-78

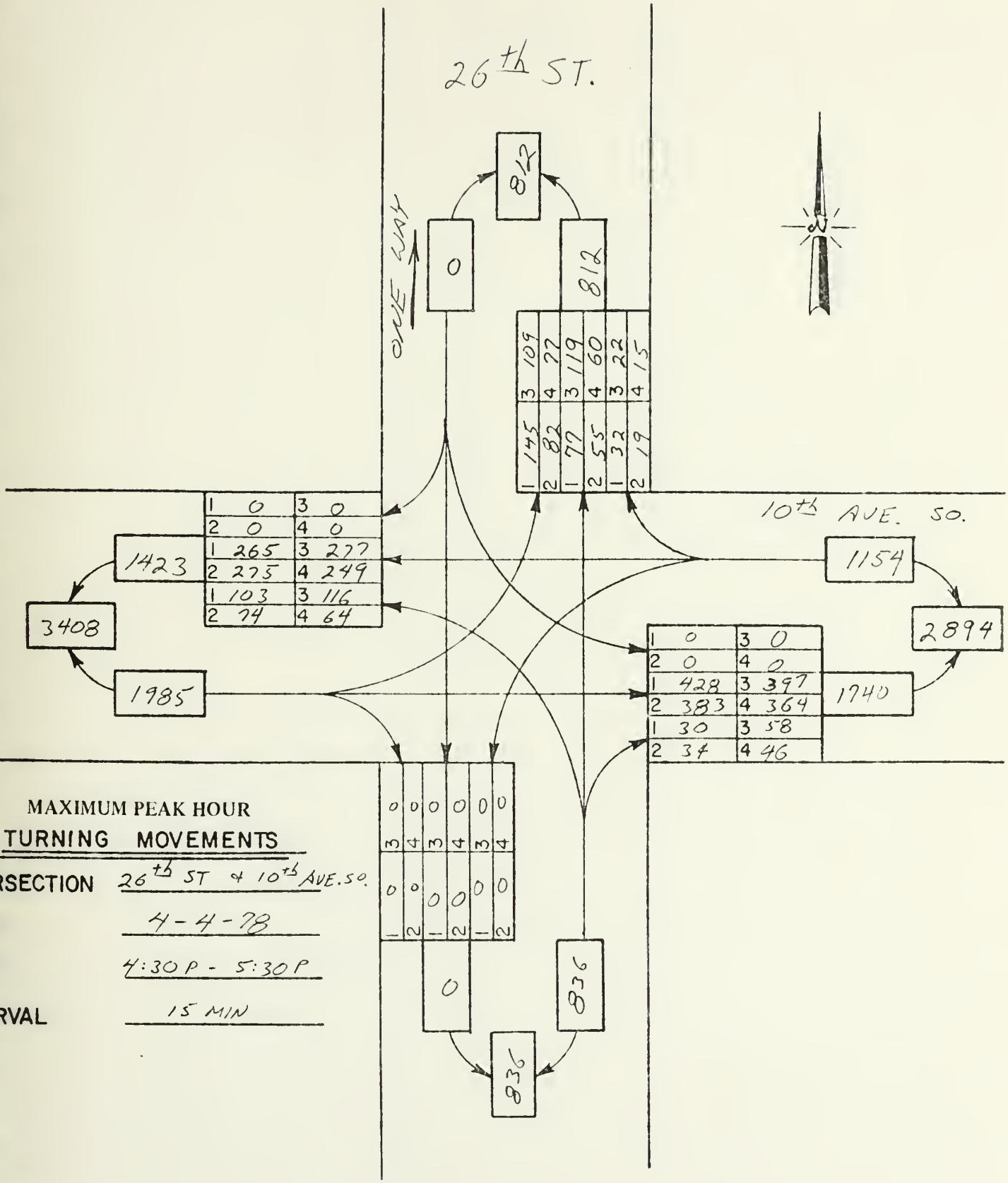
TIME 4:00 P - 5:00 P

INTERVAL 15 MIN.

Prepared by:
ROBERT PECCIA & ASSOCIATES
Helena - Havre



Prepared by:
ROBERT PECCIA & ASSOCIATES
Helena - Havre



MAXIMUM PEAK HOUR
TURNING MOVEMENTS

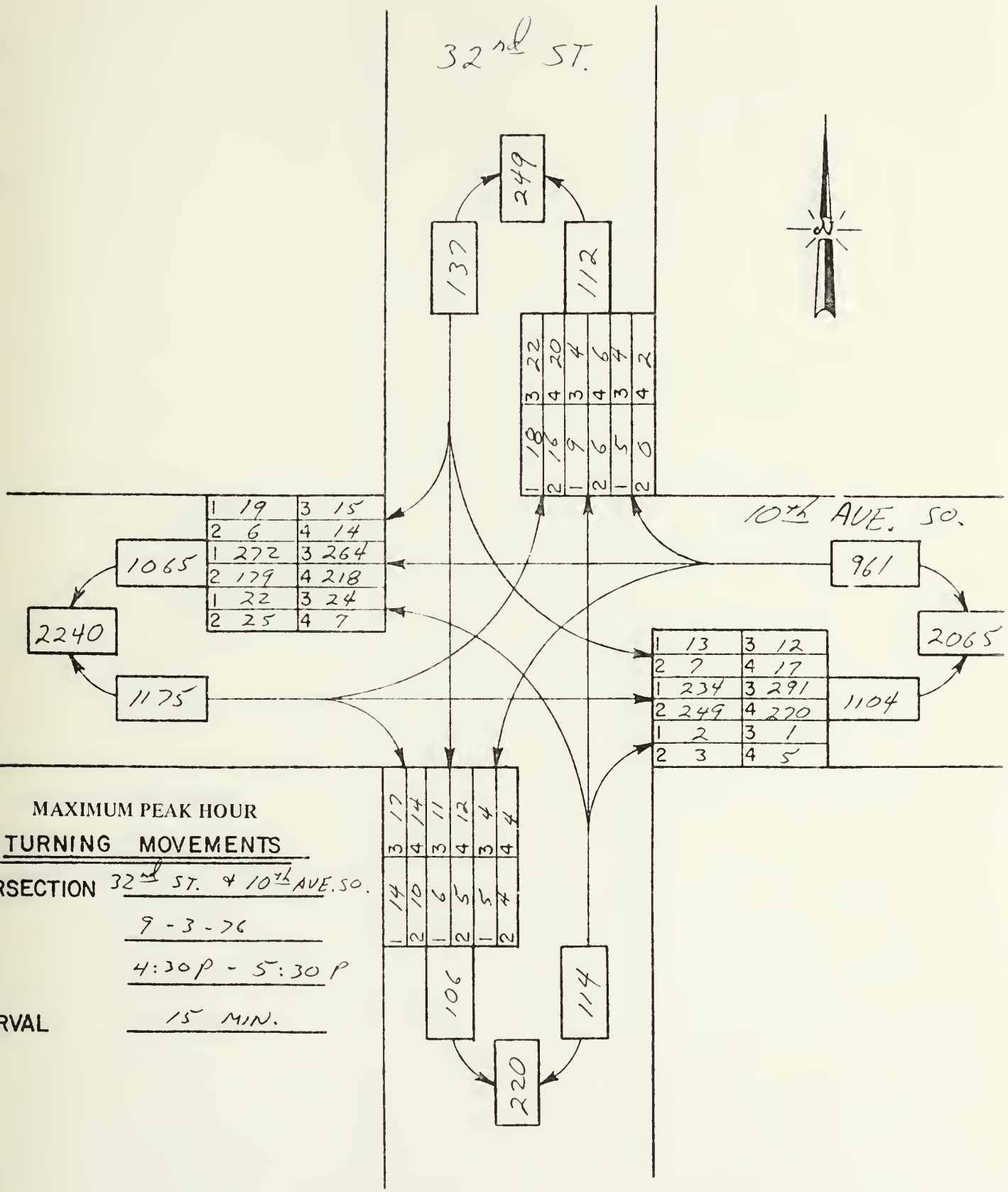
INTERSECTION 26th ST & 10th AVE. SO.

TE 4-4-78

TIME 4:30 P - 5:30 P

NTERVAL 15 MIN

Prepared by:
ROBERT PECCIA & ASSOCIATES
Helena - Havre



MAXIMUM PEAK HOUR

TURNING MOVEMENTS

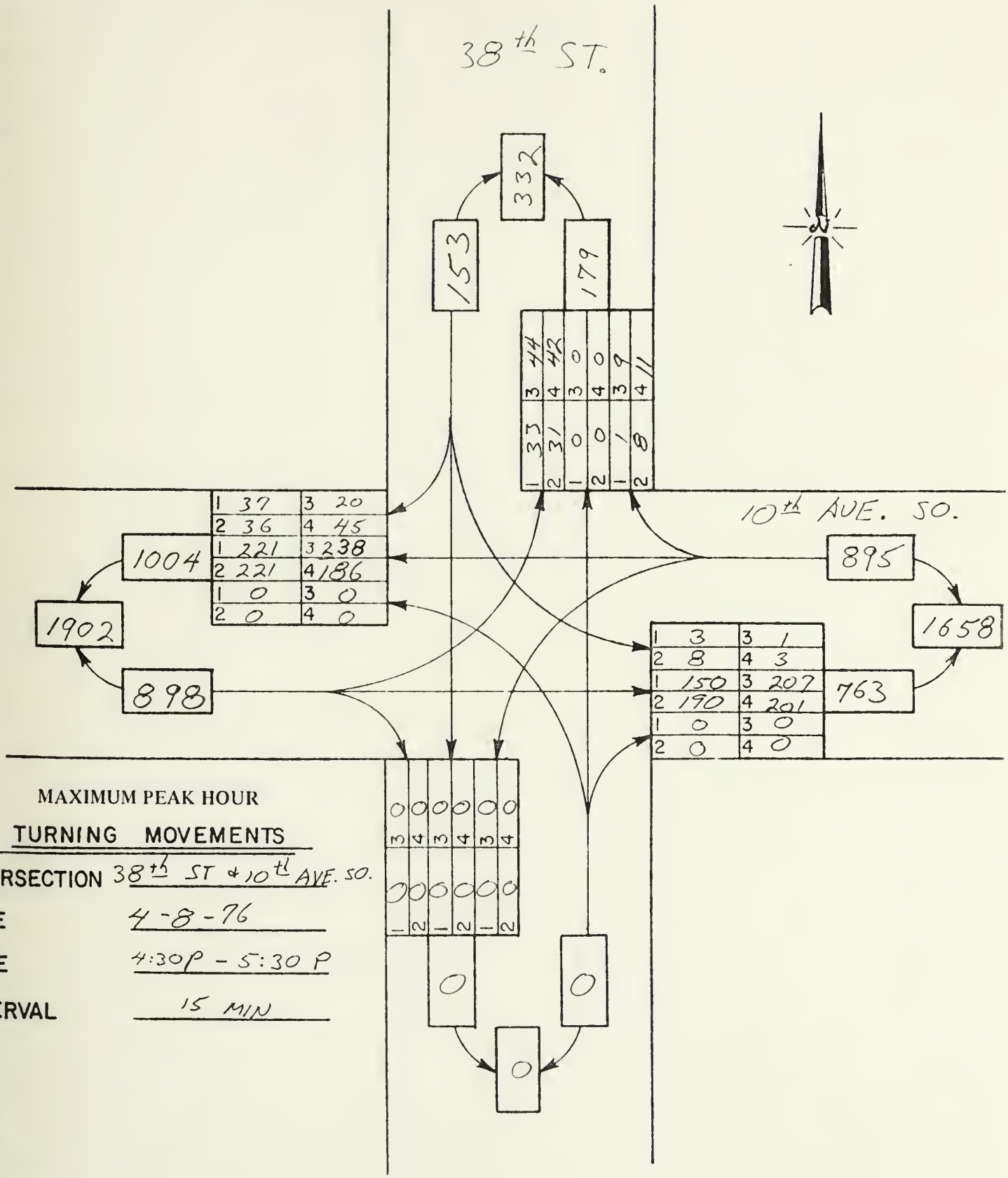
INTERSECTION 32nd ST. & 10th AVE. SO.

DATE 9-3-76

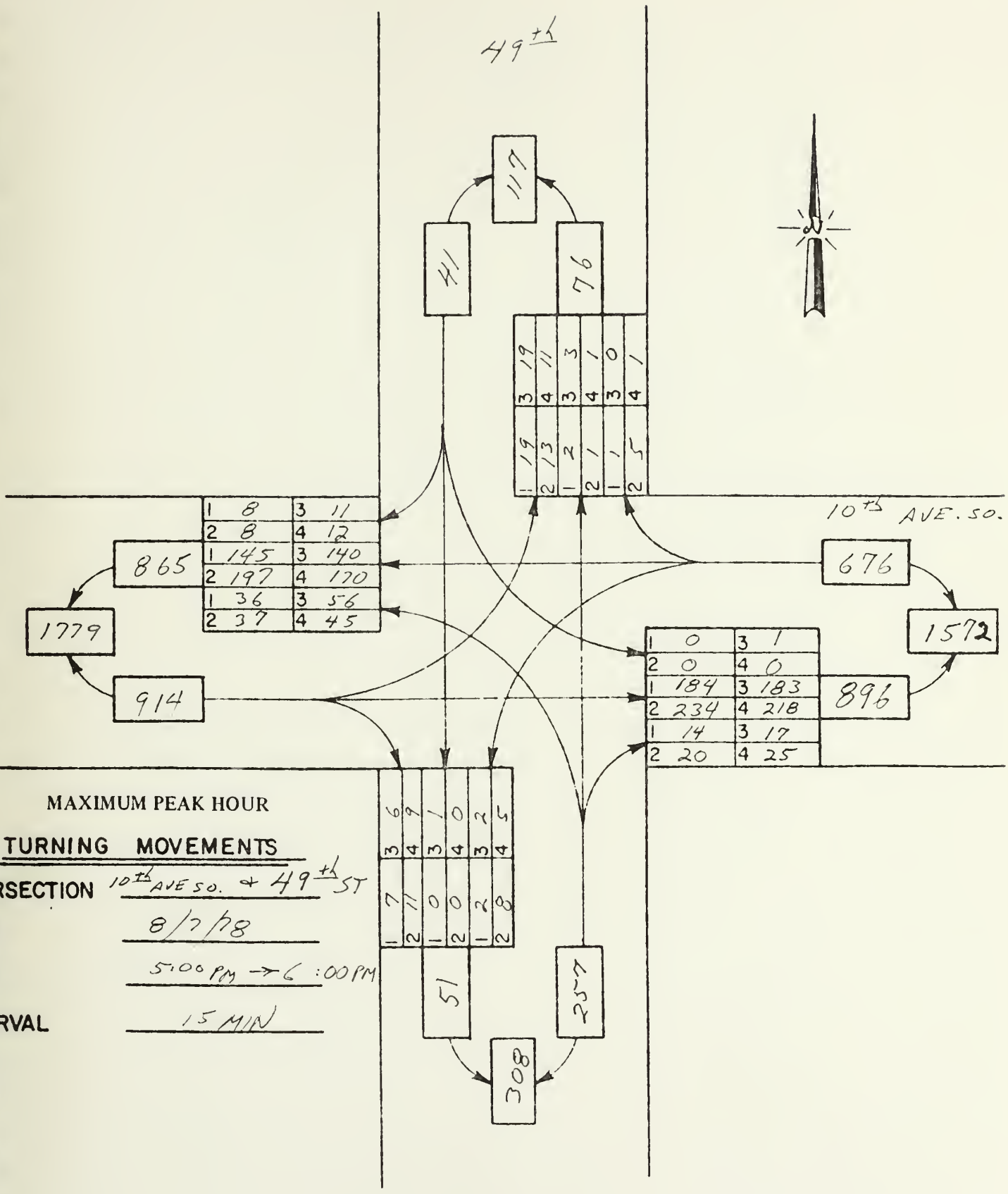
TIME 4:30 P - 5:30 P

INTERVAL 15 MIN.

Prepared by:
ROBERT PECCIA & ASSOCIATES
Helena - Havre



Prepared by:
ROBERT PECCIA & ASSOCIATES
Helena - Havre



MAXIMUM PEAK HOUR

TURNING MOVEMENTS

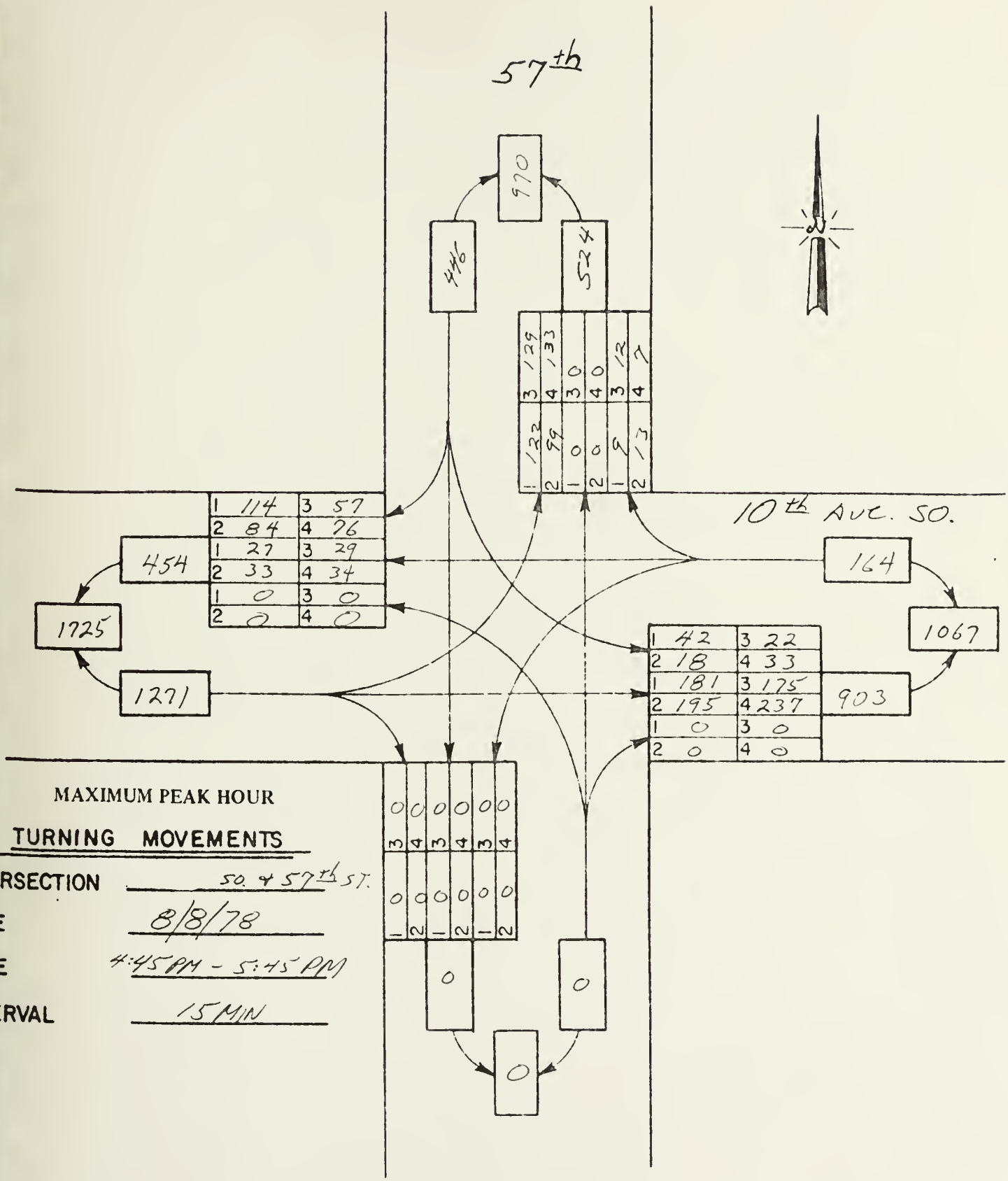
INTERSECTION 10 ±t AVE SO. & 49 ±t ST

DATE 8/7/78

TIME 5:00 PM → 6:00 PM

INTERVAL 15 MIN

Prepared by:
ROBERT PECCIA & ASSOCIATES
Helena - Havre



MAXIMUM PEAK HOUR

TURNING MOVEMENTS

INTERSECTION 50. & 57th ST.

DATE 8/8/78

TIME 4:45 PM - 5:45 PM

INTERVAL 15 MIN

Prepared by:
ROBERT PECCIA & ASSOCIATES
Helena - Havre

APPENDIX C

LIGHTING ANALYSIS SUMMARY

APPENDIX C

LIGHTING ANALYSIS SUMMARY

There has been much discussion about the relative merits of high pressure sodium vapor luminaires as compared to mercury vapor luminaires. Both types of lighting systems are found on Tenth Avenue South.

An informational guide for roadway lighting which contains standards for street lighting and criteria for evaluation is published by the American Association of State Highway Officials. In order to utilize this criteria, field measurements of the intensity of street lighting is required.

Light intensity tests to determine the average maintained horizontal foot-candles of illumination were taken at four locations on Tenth Avenue South. Two locations were chosen where the street lights were high pressure sodium vapor; one location where the street lights were supplemented with adjacent commercial lighting and one without. Two locations were chosen at mercury vapor luminaires; one with supplemental commercial lighting and one without.

The results or these tests are contained in this section of the Technical Supplement.

10TH AVENUE SOUTH - GREAT FALLS

LIGHTING SUMMARY

A.A.S.H.O. STANDARDS FOR A MAJOR ARTERIAL STREET

AVERAGE MAINTAINED HORIZONTAL FOOTCANDLES = 2.0

ILLUMINATION UNIFORMITY RATIO = 3:1 TO 4:1

AREAS WITH MERCURY VAPOR SYSTEM

WARDEN BRIDGE - 28TH STREET

34TH STREET - 38 TH STREET

AREAS WITH SODIUM VAPOR SYSTEM

28TH STREET - 34TH STREET

38TH STREET - 57TH STREET

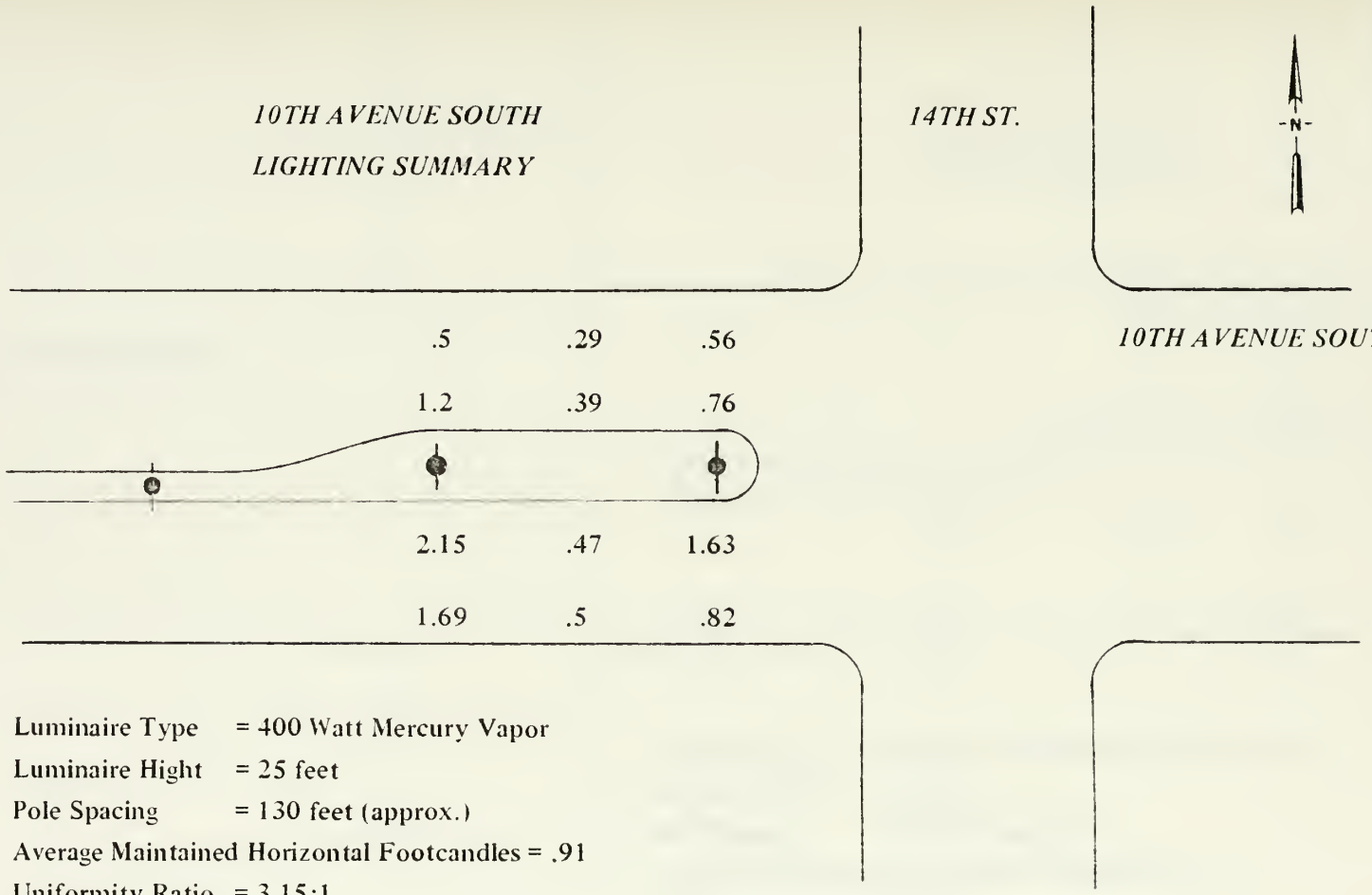
November, 1978

Daily-Peccia & Associates

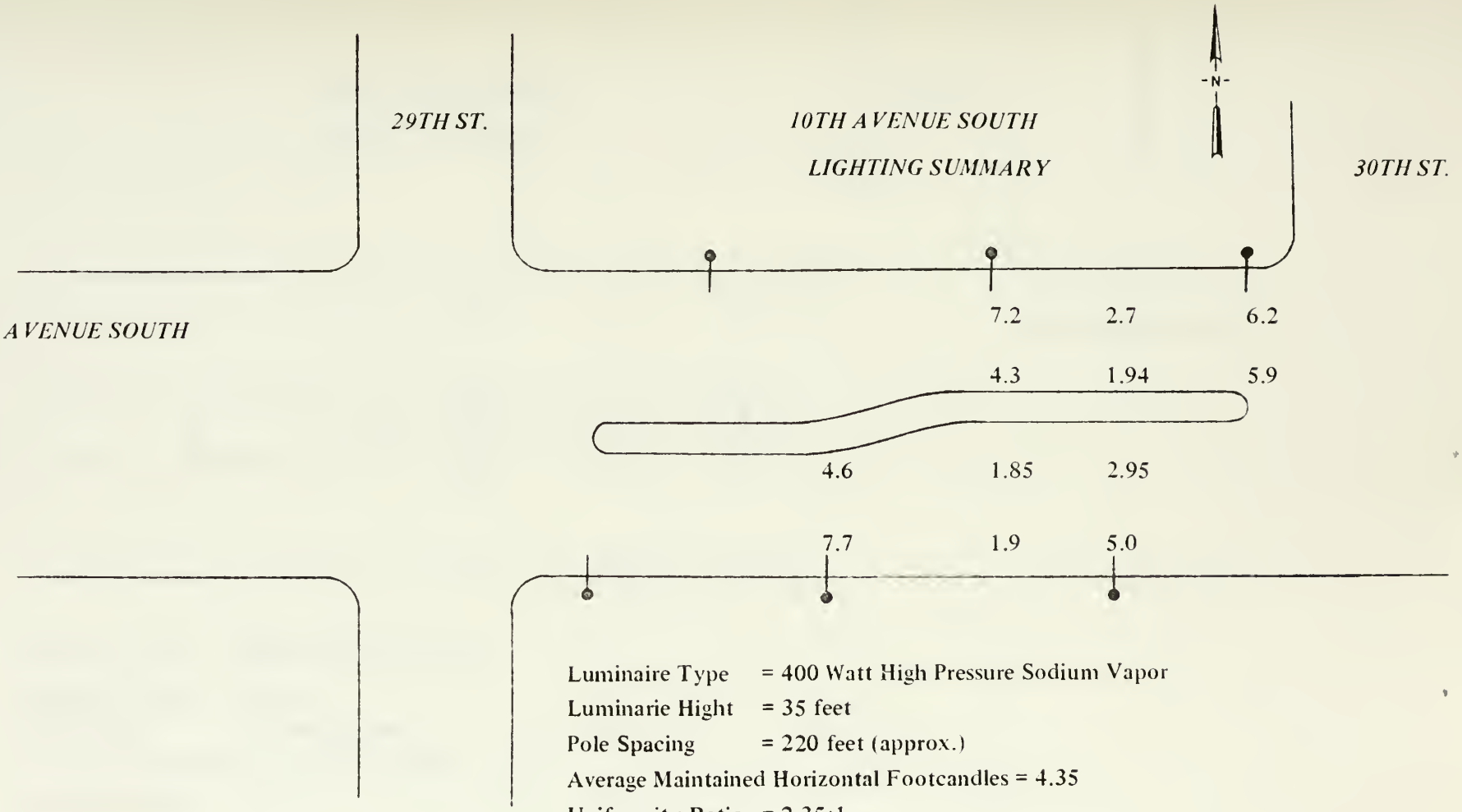
10TH AVENUE SOUTH

LIGHTING SUMMARY

14TH ST.



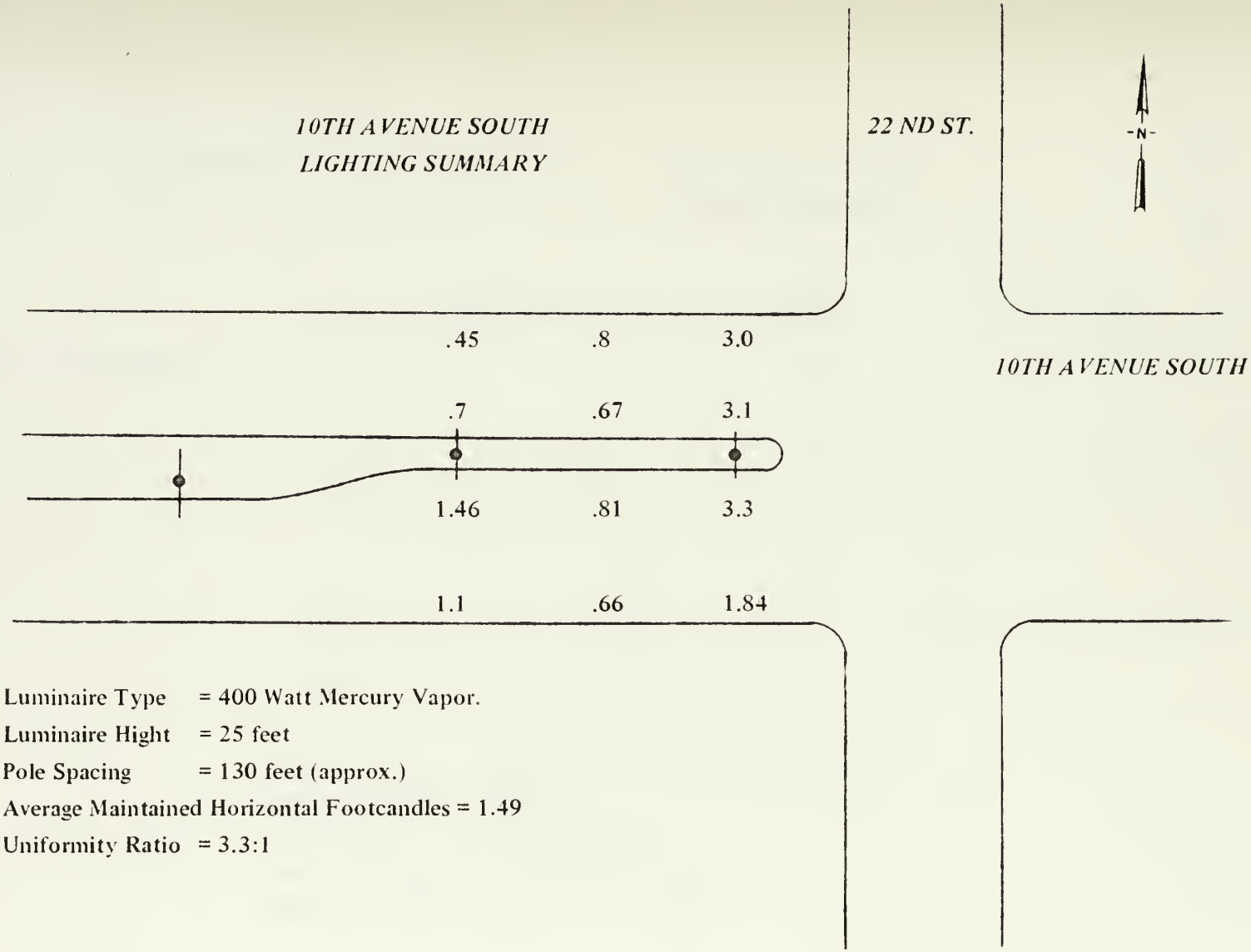
Luminaire Type = 400 Watt Mercury Vapor
Luminaire Hight = 25 feet
Pole Spacing = 130 feet (approx.)
Average Maintained Horizontal Footcandles = .91
Uniformity Ratio = 3.15:1



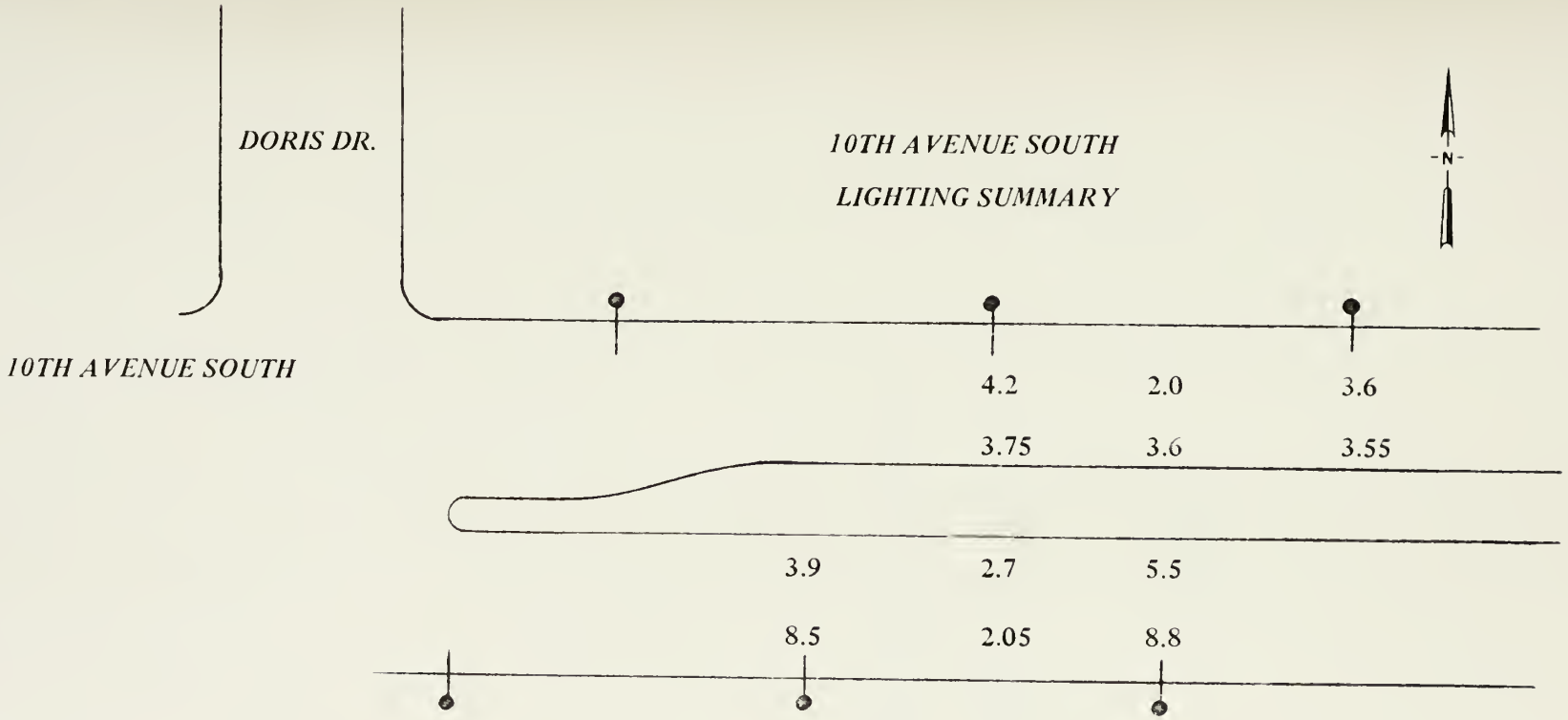
Luminaire Type = 400 Watt High Pressure Sodium Vapor
Luminarie Hight = 35 feet
Pole Spacing = 220 feet (approx.)
Average Maintained Horizontal Footcandles = 4.35
Uniformity Ratio = 2.35:1

10TH AVENUE SOUTH
LIGHTING SUMMARY

22 ND ST.



Luminaire Type = 400 Watt Mercury Vapor.
Luminaire Hight = 25 feet
Pole Spacing = 130 feet (approx.)
Average Maintained Horizontal Footcandles = 1.49
Uniformity Ratio = 3.3:1



Luminaire Type = 400 Watt High Pressure Sodium Vapor
Luminaire Hight = 35 feet
Pole Spacing = 175 feet (approx.)
Average Maintained Horizontal Footcandles = 4.35
Uniformity Ratio = 2.17:1

APPENDIX D

PRELIMINARY SUBGRADE
&
PAVEMENT EVALUATION

APPENDIX D

PRELIMINARY SUBGRADE AND PAVEMENT EVALUATION

It became apparent during the initial phase of the study that insufficient information was available to evaluate the pavement condition on Tenth Avenue South. Permission was requested from the Department of Highways to conduct soils borings and perform soils testings on the pavement section and subgrade. The soils testing firm of Northern Testing Laboratories of Great Falls was chosen to conduct the tests.

Soils borings to a depth of ten feet were done at four locations along Tenth Avenue South at locations of varying surface thicknesses, types of base course, and different subgrade conditions.

The soils tests provided information on the condition of the existing pavement and underlying soils, and recommended pavement sections that would be adequate to support the traffic loads. The soils report prepared by Northern Testing Laboratories is contained in this section of the Technical Supplement.

Soils Mechanics Engineering — Investigations
Construction Materials Evaluation and Testing
Construction Quality Control and Inspection
Chemical Analysis and Pollution Control Testing

Great Falls Billings Montana — Boise Pocatello Idaho — Gillette Wyomi

528 Smelter Avenue
P.O. Box 951
Great Falls, Montana 59401
(406) 453-1641

November 6, 1978

Daily-Peccia & Associates
One North Last Chance Gulch, Suite 3
Helena, Montana 59601

ATTENTION: Mr. Bob Peccia

Subject: Preliminary Subgrade & Pavement Evaluation - 10th Avenue South Great Falls, Montana

Gentlemen:

At your request and in accordance with our agreement dated September 27, 1978, we have made a preliminary investigation of existing surfacing and subgrade soil conditions at four selected locations on 10th Avenue South in Great Falls, Montana. We have discussed our findings with you as the work progressed, and the report which follows describes our investigations, summarizes our findings, and presents our conclusions.

Existing pavement materials, as well as subgrade soils, are quite variable. Patching and surfacing distress are common at each location. In the report which follows, we have evaluated existing materials, and have provided alternatives for consideration for upgrading or reconstruction of the street.

If you have any questions regarding this report, or if we can be of further service, please contact us.

Respectfully submitted,

Leland J. Walker

Leland J. Walker, P. E.

Dennis A. Williams, P. E.

LJW/DAW/mb
Enclosure
In quadruplicate

REPORT
OF
PRELIMINARY SUBGRADE & PAVEMENT EVALUATION

10th AVENUE SOUTH
Great Falls, Montana

TO
DAILY-PECCIA & ASSOCIATES
Helena, Montana

PREPARED
BY
NORTHERN TESTING LABORATORIES, INC.
CONSULTING SOILS ENGINEERS
Great Falls, Montana

NOVEMBER, 1978

INTRODUCTION

The purpose of this investigation was to obtain information concerning the existing surfacing and subgrade conditions and engineering properties of existing materials and subsoil, on which to base preliminary estimates for upgrading or reconstruction of 10th Avenue South between the Warden Bridge and 52nd Street, in Great Falls, Montana.

Traffic data, as well as original construction information for the existing highway, were provided by your office.

SITE INVESTIGATIONS

At four predetermined intersections, we made a careful examination of surface conditions. Based upon the examination, four test borings were drilled to depths varying from 8.6 to 10.0 feet, at locations shown on the enclosed Drawing No. 78-901-1. Boring locations were determined by tape measurement from curbs, median, or inlet structures. The boring locations should be considered accurate only to the degree implied by the method used.

Continuous logs of the soil conditions were recorded, standard penetration resistance tests made, soil and surfacing samples obtained, and pavement cores taken, during the field drilling program.

LABORATORY INVESTIGATIONS

Samples obtained during the field exploration were taken to the laboratory where they were carefully inspected and visually classified in accordance with the Unified Soils Classification System. Representative samples were selected for tests to determine the engineering and physical properties of the soils.

These included:	To determine:
Grain-size distribution.....	size and distribution of soil particles, i.e., clay, silt, sand, gravel.
Atterberg limits.....	the consistency and "stickiness," as well as the range of moisture content within which the material is "workable."
Natural moisture.....	moisture content representative of field conditions at time sample was taken.

Moisture-density relationship.....the optimum (best) moisture content for compacting soil and the maximum dry unit weight (density) for a given compactive effort.

California bearing ratio (CBR).....the capacity of a subgrade or subbase to support a pavement section designed to carry a specified traffic load.

Density & Thickness of Cores.....to determine the in situ unit weight and thickness of asphalt pavement, as well as the degree of compaction and amount of voids.

Extraction & Gradation Tests.....to determine the amount of asphalt cement in the bituminous surfacing, as well as the grainsize distribution of the aggregate.

Remolded Marshall Properties Test..to determine the properties of the bituminous surfacing after reheating and compacting, under standard conditions in the laboratory.

Retained Asphalt Cement Tests.....to determine the physical properties of the asphalt cement in the existing surfacing.

The results of all field and laboratory tests are summarized on the enclosed Tables and Plates. This information, along with the field observations, was used to prepare the final test boring logs shown on the Drawing and on the logs in the Appendix. Sampling and testing procedures are further described in the Appendix.

SITE AND SUBSOIL CONDITIONS

The four areas chosen for the preliminary evaluation were at the intersections of 10th Avenue South with 3rd, 10th, 17th, and 26th Streets. The areas and conditions are described as follows:

3rd Street South (ramps) (Drill Hole 1)

Condition

At the time of the investigation, most of the intersection area had been recently patched with a roadmix bituminous overlay. No specific failed areas were noted, but all four driving lanes showed wheel depressions.

Original Construction

The strip log indicates that in 1952 the area was surfaced with 2 inches of asphalt concrete surfacing over 14 inches of gravel base, for a total thickness of 16 inches.

Findings

The materials encountered were as follows:

0 - 7.2" of bituminous surfacing, primarily roadmix with high voids. Extracted asphalt cement was very soft with a large amount of volatile material (cutback) still present throughout the layer.

7.2" - 12.0": Gravel base to 3-inch size, compact and relatively clean, with 6 percent passing the No. 200 mesh sieve.

12.0" - 19.2": Gravel base to 3-inch size containing some clay fines and clay pockets.

19.2" - 21.6": Silty clay fill which is moist and moisture-sensitive.

21.6" - 26.4": Bituminous surfacing, partially decomposed, damp, somewhat friable, but mostly intact.

Subgrade soil below 26.4 inches is claystone shale, which is decomposed and weathered to a sandy clay at the contact, becoming competent and hard at a depth of about 2 feet below the contact. The weathered and decomposed surfacing is similar to a stiff sandy clay.

10th Street South (Drill Hole 2)

Condition

In the east-bound lanes, directly over the transverse storm sewer, there is an area about 15 by 25 feet in size which shows evidence of bearing failure. Traffic has caused some of the failed and broken surfacing to heave and displace laterally.

Original Construction

The strip log indicates that the section was surfaced in 1956 with 2.5 inches of asphalt concrete over 12.5 inches of granular base, for a total of 15 inches of surfacing.

Findings

The materials encountered, from the surface, are as follows:

0 - 7.2": Bituminous surfacing, primarily roadmix, with high voids and the odor of volatile material (cutback) throughout.

7.2" - 8.4": Crushed gravel leveling course to 1/2 inch size.

8.4" - 13.2": Bituminous surfacing, decomposed, broken, loose.

13.2" - 16.8": Gravel base consisting of sandy gravel to 2 inch size. The gravel contains 14.2 percent passing the No. 200 mesh sieve, and the fines are relatively plastic with liquid limits of 25 percent and plasticity indexes of 11 percent.

16.8" - 22.8": Fill composed of damp, gravelly clay, which probably represents intermixing of the original gravel base with the underlying sand and clay subgrade.

22.8" - 43.2": Fill composed of medium firm clayey sand, containing appreciable gravel. Standard penetration resistance (N) values in the fill are about 13 blows per foot, at a moisture content of 13 percent. The soil is moisture-sensitive and the fines are somewhat plastic. A saturated CBR value of 8.6 percent was obtained for the soil, indicating the beneficial effect of the 20 to 30 percent gravel content.

Below 43.2 inches the subgrade soil is moist, firm, plastic clay, containing sulfate salts. The clay is very expansive, its strength is very moisture-sensitive, and our experience with similar soils in the area indicates that it is a very poor subgrade soil.

17th Street South (Drill Hole 3)

Condition

There is considerable deflection throughout the intersection area. About 150 feet east of the intersection, in the north lane of the westbound lanes, there is an area bout 40 feet in length which shows evidence that the entire paved surface is failing under the traffic load and shoving toward the north curb. The failure appears to be in the bituminous surfacing.

Original Construction

The strip log indicates that the section was surfaced in 1962 with 2.5 inches of asphalt concrete over 15 inches of granular base, for a total of 17.5 inches of surfacing.

Findings

The materials encountered, from the surface, are as follows:

0 - 3.6": Bituminous surfacing which is a mixture of roadmix and plantmix. The surfacing has a high void content and the effects of the volatile cutback in the roadmix are present.

3.6" - 6": Crushed sandy gravel leveling course to 1/2 inch size.

6" - 18": Clayey gravel base which contains 16 percent passing the No. 200 mesh sieve. Fines are plastic with liquid limit of 25 percent and plasticity index of 11 percent. This is a poor quality granular base.

Below 18 inches and extending to 6.1 feet is silty sand. The sand is fine and poorly graded. Some gravel contaminate is present to a depth of 3 feet. The soil is compact, with N values of 14 to more than 50. The soil has good saturated shear strength, and our experience with similar aeolian sand in the area indicates that it is a fair subgrade. The soil is frost susceptible.

Below the sand layer are glacial till deposits of silty and plastic clay.

26th Street South (Drill Hole 4)

Condition

Considerable deflection in the wheel lanes is visible throughout the area. In the turning lanes on the west side of the intersection, there is a failed area about 5 feet square which shows evidence of shoving and displacement of the paved surface.

Original Construction

The strip log indicates that the section was surfaced in 1962 with 3 inches of asphalt concrete pavement over 15 inches of granular base, for a total of 18 inches of surfacing.

Findings

The materials encountered, from the surface, are as follows:

0 - 6": Bituminous surfacing which is a high void mixture of roadmix and plantmix asphalt concrete.

6" - 8.4": Sandy gravel base to 2 inch size, containing 10 percent passing the No. 200 mesh sieve, with a liquid limit of 24 percent and a plasticity index of 9 percent.

8.4" - 18.0": Sandy gravel base to 3 inch size, containing 18 percent passing the No. 200 mesh sieve, with a liquid limit of 24 percent and a plasticity index of 9 percent. This is a poor quality granular base.

18" - 5.2': Fill consisting of silty sand with gravel, sandstone fragments, silt and clay. Clay zones up to 0.3 feet thick are present. The fill is compact to loose, with N values of from 41 to 6. The beneficial effects of the gravel and sand are noted in the saturated CBR value of 24 percent. The soil is frost susceptible.

Below the fill is weathered, fractured, dense sandstone.

ENGINEERING ANALYSIS

Traffic Considerations

Traffic data as follows was provided:

1977-78 A.D.T.....30,000 vehicles per day, 4 lanes, 2 ways.
D.H.V..... 2,500 vehicles per hour, 4 lanes, 2 ways.
Heavy trucks, percent.....5

Since the facility is near capacity at this time, our analysis considered only the "as-is" traffic conditions without growth.

Subgrade

Although a much more comprehensive study would be required to delineate and define subgrade soil conditions for actual design, the preliminary information indicates that three major subgrade soil types will control design in the section studied -- weathered claystone, plastic or silty clay, and fine silty sand (blowsand). The claystone weathers rapidly and slakes to a sandy or silty clay soil and, for that reason, the properties of the decomposed shale may be considered similar to those of the silty or plastic clay. It is obvious from the two CBR tests that gravel mixed in any quantity with the soils will appreciably increase the subgrade support properties of all of the soils. Our experience with the uncontaminated natural soils in the area indicate that the following subgrade support properties are applicable:

Silty & Plastic Clay and Decomposed Shale..CBR = 2%
Silty Sand (Blowsand).....CBR = 7%

For the purpose of this preliminary evaluation, these values have been used.

Design Thickness Requirements

Using current Asphalt Institute criteria for the as-is traffic conditions, full-depth surfacing section requirements are as follows:

	CBR = 2	CBR = 7
	Thickness, Inches	
Asphaltic Concrete Surfacing...	4.0	4.0
Asphaltic-Treated Base.....	10.5	5.0
Totals	14.5	9.0

Since the present granular base most approximates an uncrushed 3 inch sandy gravel, the thickness requirements may be restated for comparison, as follows:

	CBR = 2	CBR = 7
	Thickness, Inches	
Asphaltic Concrete Surfacing...	4.0	4.0
3/4-Inch Crushed Leveling.....	2.0	2.0
3-Inch Uncrushed Base Course...	25.5	11.0
Totals	31.5	17.0

Equivalency Evaluation

Using equivalency factors which consider the properties of the existing materials, as compared to the properties of the generally specified construction materials used in the Asphalt Institute design criteria, the sections at the several locations would be approximately as follows:

3rd Street South - Claystone Shale Subgrade:

	Equivalent Section in Place, Inches
Asphaltic Concrete Surfacing	4.0
3/4-Inch Crushed Leveling	2.0
3-Inch Uncrushed Base Course	11.5
Total Equivalency	17.5

This would indicate that the section is lacking 14 inches of uncrushed base or 5 inches of asphalt concrete surfacing to support existing traffic.

10th Street South - Clay Subgrade

	Equivalent Section in Place, Inches
Asphaltic Concrete Surfacing	4.0
3/4-Inch Crushed Leveling	2.0
3-Inch Uncrushed Base Course	13.2
Total Equivalency	19.2

This would indicate that the section is lacking 12.3 inches of uncrushed base or 4.5 inches of asphalt concrete surfacing to support existing traffic. However, there is 1.7 feet of clayey sand fill which has considerably better subgrade properties than the clay.

17th Street South - Sand Subgrade

	Equivalent Section in Place, Inches
Asphaltic Concrete Surfacing	2.9
3/4-Inch Crushed Leveling	2.0
3-Inch Uncrushed Base Course	10.3
Total Equivalency	15.2

This indicates that the section is lacking 1.1 inches of asphaltic concrete surfacing and 0.7 inch of 3-inch uncrushed base, or 1.4 inches of asphaltic concrete surfacing, to support the existing traffic.

26th Street South - Sand Subgrade

	Equivalent Section in Place, Inches
Asphaltic Concrete Surfacing	4.0
3/4-Inch Crushed Leveling	2.0
3-Inch Uncrushed Base Course	10.5
Total Equivalency	16.5

This is essentially adequate to support the design traffic.

Other Considerations

In the case of this high volume traffic facility, the equivalency concept is misleading because there are certain problems that cannot be resolved strictly by consideration of equivalencies.

For example, the existing bituminous surfacing has had so many generations of roadmix repair and "half-sole" that the residual bituminous cement has been severely softened by the cutback and does not have the physical properties required to support heavy truck loading. This is obvious from the amount of shoving and rutting in the pavement. This problem cannot be resolved by just overlay, since the soft layer would still be present within the zone of influence of the imposed wheel loads.

Another problem is the gravel "sandwich" sections found at 3rd Street and 10th Street, in which granular base material is sandwiched between two layers of bituminous surfacing. It is generally accepted that this condition will usually result in failure under heavy traffic due to moisture entrapment between the two bitumen layers.

A third consideration is the quality of the granular base. Whether by contamination from below, degradation, or original quality, the base gravel throughout most of the section examined contains far too much minus 200 mesh (silt and clay) material, and is too plastic to be considered a quality granular base for support of heavy traffic. The detrimental low-saturated strength of the silt-clay fraction within the gravel is made even more critical since there is considerable evidence of poor drainage. Through the section surfaced in 1962, it might be possible to utilize this granular material in a surfacing section for the facility, but it can only be considered as a subbase material.

CONCLUSIONS

1. For preliminary evaluation and estimating purposes, the section from 3rd Street to 13th Street should be considered as having clay subgrade; the remainding subgrade should be considered to be sand. This <u>will not</u> be the actual case, and a comprehensive soil survey will be required to better delineate subgrade soils.

2. From 3rd Street to 16th Street, reconstruction of the entire pavement section will be required for adequate support of the existing traffic. For preliminary estimates, one of the surfacing sections shown in the Engineering Analysis section for CBR = 2, or an equivalent, should be used.

3. From 16th Street to the end of the section examined, all of the existing bituminous material should be removed. If the existing subbase gravel is to be salvaged as part of the section, all of the existing bituminous surfacing should be removed and the section paved with 4 inches of asphalt concrete surfacing over 2.5 inches of asphalt-treated base.

4. For any reconstruction to succeed, the drainage of the entire facility must be improved.

5. Materials specifications from the Standard Specifications for Road and Bridge Construction, MDOH 1976, should be used for preliminary estimating purposes.

6. This evaluation must be considered preliminary only, for the purpose of a broad overview of the conditions. A much more comprehensive soils investigation will be necessary for facility design.

The preliminary conclusions given in this report are based on the results of the field and laboratory investigations, combined with interpolation of the subsurface conditions between widely spaced borings. The information should be considered preliminary in nature and used for preliminary evaluation only.

APPENDIX

EXPLORATION AND LABORATORY TESTING

Exploration

Field exploration is performed using truck or skid mounted rotary drilling machine equipped with either augers, tricone rock bits, or coring apparatus. Standard penetration testing and undisturbed sampling can be performed through our hollow stem auger which serves as casing. When drilling in large, dense gravel, rock fragments or bedrock, special casing is usually required to maintain an open hole. The soils are continuously logged by our field personnel and classified by visual examination in accordance with the Unified Soils Classification System.

Samples of soils are taken at frequent intervals in the boring excavation. Disturbed samples are normally taken by the standard penetration test. This test is made by driving a 2-inch O.D. split spoon sampler 18 inches into the soil by striking it with a 140 pound hammer dropping 30 inches. The total number of blows required to advance the sampler the second and third six inch increments is the standard penetration resistance. Occasionally, a cone penetrometer will be driven continuously from the ground surface to locate soft zones or to simulate the driving of piling into subsurface soils. The cone is 1-13/16 inches in diameter and is driven with the same hammer and dropping distance as the standard penetrometer. Undisturbed samples are obtained from layers of soil that are critical to the analysis. Samples of representative soils are obtained by pushing, or possibly driving, a thin-walled steel sampler into the soil layer. The soil is retained in brass rings of 2.00 and 2.50 inches in diameter, and 1.00 inches in height. Normally, the central six inch portion of the sample is retained in close-fitting, plastic, waterproof containers which are in turn placed in cushioned boxes for shipment to the laboratory. Occasionally, thin-walled shelby tubes are used to sample sensitive soils that are easily disturbed.

Under certain conditions and with certain project requirements, in-place vane shear, percolation, resistivity and/or California bearing ratio tests may be performed in accordance with standard procedures.

Laboratory Classification and Testing

The field classification is verified in the laboratory, where all of the samples are classified by someone other than the person who made the field classification. The classification process in the laboratory normally includes estimation of the percents of gravel or rock fragments, sand, silt, and clay fractions, and the liquid and plastic limits. The natural moisture content of all of the fine-grained soil and bedrock samples is determined.

Based on the classification tests, one or more of each representative type of soil encountered is selected for more detailed analysis. The data from the field and the laboratory investigations is used to prepare the final test boring logs (shown on the Drawing).

NORTHERN TESTING LABORATORIES, INC.
CONSULTING GEOTECHNICAL ENGINEERS
Great Falls, Billings, Montana - Boise, Idaho - Gillette, Wyoming

SUMMARY OF FIELD AND LABORATORY TEST RESULTS
Preliminary Subgrade & Pavement Evaluation
10th Ave. So., Great Falls
TABLE NO. I

Job No. 78-901

Boring Number	Depth in Feet	Classification	Penetration Test Blows Per Foot	Moisture Content Percent	Atterberg Limits: Liquid Limit,%	Atterberg Limits: Plastic Limit,%	Atterberg Limits: Plasticity Index	Gradation Percent Retained: Gravel	Sand	Silt	Clay
H 1	0.0 - 0.6	Bituminous Surfacing	--	--							
		See Plate No. 1 & Table II for Additional Test Data									
	0.6 - 1.0	FILL; Gravel, Sandy						64	30	- 6 -	
		See Table III for Additional Test Data									
	1.0 - 1.6	FILL; Gravel, Sandy	--	--				73	20	- 7 -	
		See Table III for Additional Test Data									
	2.2 - 3.1	SHALE, Claystone	30	13							
	3.5 - 5.0	SHALE, Claystone	51	13	40	19	21	0	4	66	30
	5.0 - 6.5	SHALE, Claystone	55	11							
	8.5 - 10.0	SHALE, Claystone	47	12							
H 2	0.0 - 0.6	Bituminous Surfacing	--	--							
		See Table II for Additional Test Data									
	0.6 - 0.7	FILL; Gravel, Sandy	--	--				52	48	- 0 -	
		See Table III for Additional Test Data									
	0.7 - 1.1	Bituminous Surfacing	--	1				37	61	- 2 -	
		See Table III for Additional Test Data									
	1.1 - 1.4	FILL; Gravel Sandy	--	3	25	14	11	64	32	9	5
		See Table III for Additonal Test Data									
	1.9 - 2.2	FILL; Sand, Clayey	13	13	25	15	10	21	45	20	14
	2.2 - 3.5	FILL; Sand, Clayey	--	--	30	16	14	29	42	16	13
		See Plate II for Additional Test Data									
	3.6 - 5.0	CLAY, Plastic	13	31							
	5.0 - 6.5	CLAY, Plastic	27	33							
	6.5 - 8.0	CLAY, Plastic	18	27							
	8.5 - 8.0	CLAY, Plastic	15	30							

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SUMMARY OF FIELD AND LABORATORY TEST RESULTS
Preliminary Subgrade & Pavement Evaluation
10th Ave. So., Great Falls
TABLE NO. I

Job No. 78-901

Boring Number	Depth in Feet	Classification	Penetration Test Blows Per Foot	Moisture Content Percent	Atterberg Limits: Liquid Limit,%	Plastic Limit,%	Plasticity Index	Gradation Percent Retained: Gravel	Sand	Silt	Clay
DH 3	0.0 - 0.3	Bituminous Surfacing	--	--							
		See Table II for Additional Test Data									
	0.3 - 0.5	FILL; Gravel, Sandy	--	12							
	0.5 - 1.5	FILL; Gravel, Clayey	--	--	25	14	11	56	28	10	6
		See Table III for Additional Test Data									
	1.8 - 3.3	SAND, Silty	55	5	Granular Non-Plastic			11	72	10	7
	3.5 - 5.0	SAND, Silty	14	11							
	5.0 - 6.1	SAND, Silty	9	16							
	6.5 - 7.6	CLAY, Silty	7	24							
	8.5 - 10.0	CLAY, Plastic	13	31							
DH 4	0.0 - 0.5	Bituminous Surfacing	--	--							
		See Table II for Additional Test Data									
	0.5 - 0.7	FILL; Gravel, Sandy	--	5	24	15	9	65	25	6	4
		See Table III for Additional Test Data									
	0.7 - 1.5	FILL; Gravel, Sandy	--	--	24	15	9	63	19	12	6
		See Table III for Additional Test Data									
	1.5 - 3.0	FILL; Sand, Silty	41	6	Granular Non-Plastic			22	54	15	9
		See Plate No. III									
	3.5 - 5.0	FILL; Sand, Silty	6	5							
	5.2 - 5.4	Sandstone	50/0.4	5							

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SUMMARY OF ASPHALT CONCRETE TESTING
PRELIMINARY SUBGRADE & PAVEMENT EVALUATION
10th AVENUE SOUTH, GREAT FALLS, MONTANA
TABLE NO. II

Job No. 78-901

Drill Hole No.	1	1	2		3	4	
Depth, Feet	0.0 - 0.6 Core	0.0 - 0.6 Core	0.0 - 0.6	Mont. Dept. of Highway Spec. Art. 30-02, Grade D	0.0 - 0.3	0.0 - 0.4	Mont. Dept. of Highway Spec. Art. 30-02, Grade B
Lab No.	148067	148066 & 148068 Combined	148076		148090 & 148091 Combined	148104	
	Percent Passing Screen or Sieve Size Shown						
3/4"					100		100
1/2"	100	100		100	90		80 - 100
3/8"	94	94		75 - 100	76		70 - 90
No. 4	66	65		50 - 72	52		45 - 65
No. 10	44	47		35 - 50	36		32 - 45
No. 20	33	36			30		
No. 30		30					
No. 40	28	30		16 - 28	26		15 - 25
No. 50		24					
No. 80	16				14		
No. 100		11					
No. 200	6.7	5.0		5 - 11	6.0		4 - 10
Asphalt Content, %	4.2	4.4		4 - 7	5.8		4 - 7
% Volatiles		0.05					
Unit Weight, pcf			145.4			141.9	
Marshall Properties:							
Stability, pounds	2590				3210		
Flow, 0.01 inches	15.0				12.5		
Marshall Density, pcf	138.4				138.4		
Retained Penetration, 100/5		300+					
Ash Content, %		0.68					

NORTHERN TESTING LABORATORIES, INC.
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Great Falls, Billings, Montana - Boise, Pocatello, Idaho - Gillette, Wyoming

SUMMARY OF GRANULAR BASE COURSE TESTING
PRELIMINARY SUBGRADE & PAVEMENT EVALUATION
10th AVENUE SOUTH, GREAT FALLS, MONTANA
TABLE NO. III

Job No. 78-901

Drill Hole No.	1	1	2	2	2	3	4	4	Mont. Dept.
Depth, Feet	0.6 - 1.0	1.0 - 1.6	0.6 - 0.7	0.7 - 1.1	1.1 - 1.4	0.5 - 1.5	0.5 - 0.7	0.7 - 1.5	of Highway
Lab No.	148070	148071	148080	148081*	148082	148095	148106	148107	Spec. M-100.05** All Grades 1 thru 6
				Percent Passing Screen or Sieve Size Shown					
4"		100							
3"		92				100		100	
2"	100	79				97	100	92	
1-1/2"	91	75			100	94	85	83	
1"	81	64			86	82	74	74	
3/4"	72	57	100	100	82	75	63	67	
1/2"	60	46	96	99	72	65	50	56	
3/8"	52	39	82	91	63	56	44	48	
No. 4	36	27	48	63	46	44	35	37	25 - 60
No. 10	29	21	24	35	36	37	29	32	
No. 20	24	18	12	22	31	34	25	30	
No. 40	22	17	6	14	27	32	22	29	
No. 80	12	11	1	5	20	24	15	23	
No. 100	10	10	1	4	18	22	13	21	
No. 200	6.0	6.5	0.4	1.8	14.2	16	9.7	17.5	12 Max.
Atterberg Limits:									
Liquid Limit, %					25	25	24	24	
Plastic Limit, %					14	14	15	15	
Plasticity Index, %					11	11	9	9	

*Sample contained considerable oil.

**Crushing is not a requirement.

CONTRACT NUMBER
REPORT NUMBER

CHICAGO TESTING LABORATORY, INC. FOUNDED

GENE ABSON, P.E. (1897-1963)
NWAY C. BURTON, P.E.
RD K. PARR, P.E.
RICHARD E. ROOT, P.E.
GEORGE J. GIROUX, B.S.

3360 COMMERCIAL AVENUE: NORTHBROOK, ILLINOIS 60062 (312) 498-

BITUMINOUS MIXTURE ANALYSIS

DATE Oct. 24, 1978
LABORATORY NO. 68992

D Northern Testing Laboratories
528 Smelter Avenue
P.O. Box 951
Great Falls, Montana 59403

IDENTIFICATION DH-1, 10th Avenue South Pavement, Lab. No. 148066 148068 - P.O. No. 2345

ATE OF SAMPLE .....
ATE RECEIVED 10/17/78
SAMPLE FROM .. ..PLANT ☐ .....STREET ☒

TAKEN BY: Henry Sivumaki
CONTRACTOR: --
SPECIFICATION: --

GGREGATE GRADATION, CUMULATIVE PASSING, %:	
1/2"	100.0
3/8"	93.9
No. 4	64.6
No. 8	46.9
No. 16	36.2
No. 30	29.7
No. 50	23.6
No. 100	10.8
No. 200	5.0
BITUMEN, % OF TOTAL MIX	4.4
% Volatiles	0.05

XTURE ANALYSIS, %
PASSING RETAINED

ITUMEN.....

MAX. SPEC. GRAV. (ZAVD)	
MARSHALL TEST, AVG. of	
LAB. COMPACTED SPECIMENS,	
BLOW COMPACTION: @ °F:	
SPECIFIC GRAVITY @77°F	
AIR VOIDS, %	
AGGREGATE VOIDS, %:	
TOTAL (VMA)	
FILLED (V_f)	
STABILITY @ °F, lb.	
FLOW @ °F, 0.01 in	
PAVEMENT or CORE DATE:	
SPECIFIC GRAVITY @ 77°F	
AIR VOIDS, %	
AGGREGATE VOIDS, %:	
TOTAL (VMA)	
FILLED (V_f)	
ASPHALT RECOVERED BY THE ABSON METHOD:	
PENETRATION @77°F, 100/5	Soft (300+)
ORIGINAL	
% of ORIGINAL	
DUCTILITY @77°F, 5/60, cm.	
ASH, %	0.68
VISCOSITY ABSOLUTE@ 140°F (P)	
PLANT FORMULA, %:	
BITUMEN	
FILLER	
FINE AGGREGATE	
COARSE AGGREGATE	
TOTAL	

During preparation of this sample for testing, a noticeable solvent odor was present. The recovered asphalt was very soft and could not be tested for penetration. The volatility test indicated a slight amount of light weight volatiles present. A comparison of the weight of material extracted to that from the recovery test indicated a higher solvent content than the volatility test. This results from the higher temperatures of the recovery test.

NTL

PLATE NO. 1

CHICAGO TESTING LABORATORY, INC.

BY

CALIFORNIA BEARING RATIO DATA SHEET

Project: Preliminary Subgrade & Pavement Evaluation, 10th Ave. So., Gt Falls
Source: DH 2
Depth: 2.0' - 3.5'
Location:
Identification:

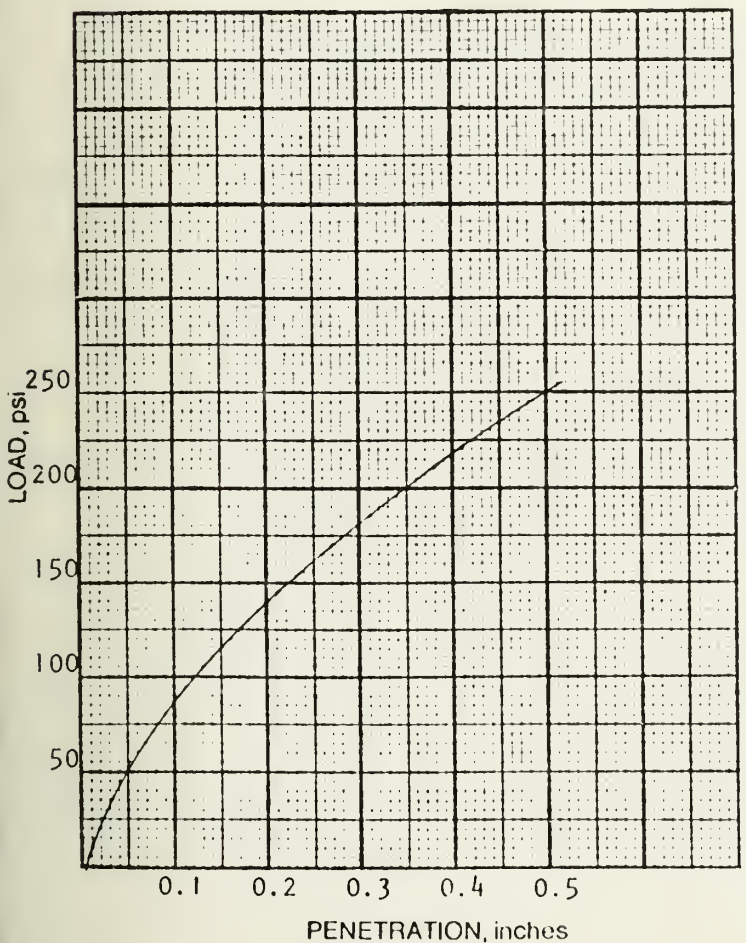
Sample No.: 148088
Job No.: 78-901
Sampled by: NTL
Date Sampled: 10-2-78
Date Received: 10-3-78

MECHANICAL ANALYSIS, % Pass

3" Sq.	100
2" Sq.	98
1" Sq.	95
¾" sq.	94
½" Sq.	89
3/8" Sq.	82
No. 4	71
No. 10	62
No. 20	58
No. 40	56
No. 80	42
No. 100	39
No. 200	29.1
0.005 mm	13.2

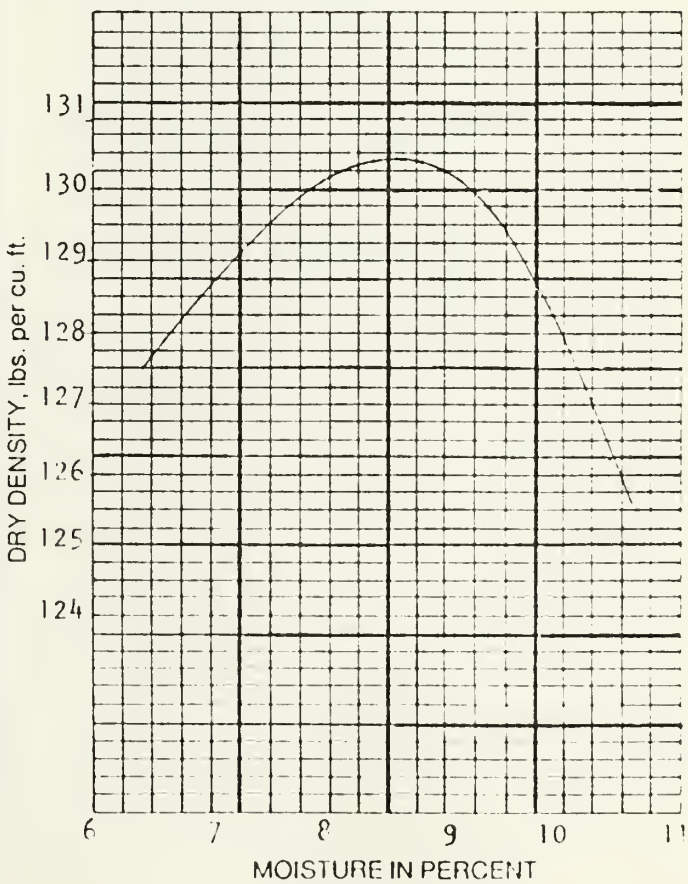
Liquid Limit: 30
Plastic Limit: 16
Plasticity Index: 14
Specific Gravity:
Texture Classification:
Soil Classification: FILL: Sand, Clayey
Test Dry Density = 123.9 pcf (95 % of 130.4)
CBR = 9.0 %
Test Specimen molded at 8.6 % moisture (optimum)
Test Performed at % moisture
Remarks:

CBR CURVE



MOISTURE-DENSITY CURVE

Method: ASTM D 1557, Method D
Max. Dry Wt.: 130.4 #/Cu. Ft.
Optimum Moisture: 8.6 %



NTL # 100

CALIFORNIA BEARING RATIO DATA SHEET

Preliminary Subgrade & Pavement

Project: Evaluation, 10th Ave. So., Gt Falls
Source: DH 4
Depth: 1.5' - 3.0'
Location:
Identification:

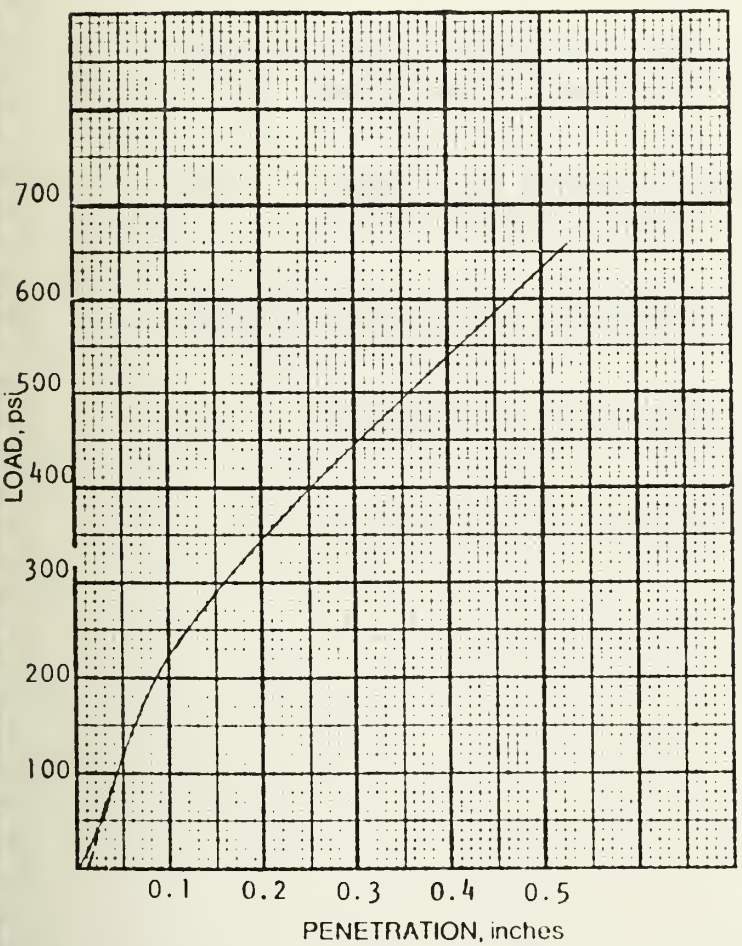
Sample No.: 148108
Job No.: 78-901
Sampled by: NTL
Date Sampled: 10-2-78
Date Received: 10-3-78

MECHANICAL ANALYSIS, % Pass

3" Sq.	
2" Sq.	100
1" Sq.	98
¾" sq.	96
½" Sq.	91
3/8" Sq.	86
No. 4	78
No. 10	74
No. 20	69
No. 40	65
No. 80	36
No. 100	32
No. 200	24.2
0.005 mm	8.7

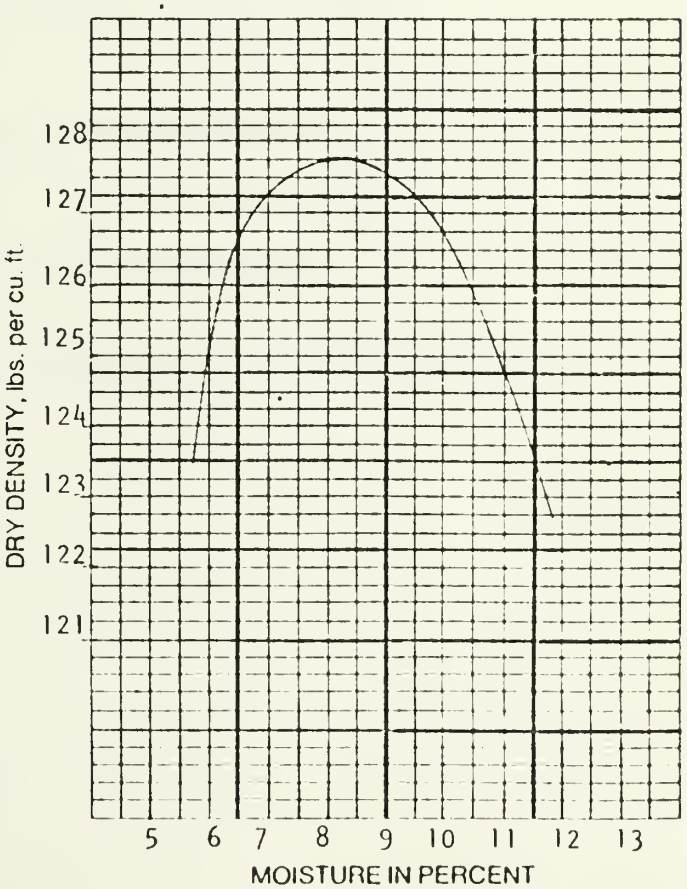
Liquid Limit: Granular
Plastic Limit: Non-Plastic
Plasticity Index:
Specific Gravity:
Texture Classification:
Soil Classification: FILL: Sand, Silty
Test Dry Density = 121.4 pcf (95 % of 127.8)
CBR = 24.0 %
Test Specimen molded at _____ % moisture (optimum)
Test Performed at _____ % moisture
Remarks: Corrected CBR

CBR CURVE



MOISTURE-DENSITY CURVE

Method: ASTM D 1557, Method D
Max. Dry Wt.: 127.8 #/Cu. Ft.
Optimum Moisture: 8.3



LOGS OF EXPLORATIONS

EXPLANATION OF ABBREVIATIONS

SSS (SPT) Standard penetration resistance test -- results recorded as the number of blows of a 140-pound hammer falling 30 inches required to drive a 2-inch O.D. split sample spoon the second and third 6-inch increments of an 18-inch distance.

LSS Modified penetration test -- results recorded as the number of blows of a 140-pound hammer falling 30 inches required to drive a 2.5-inch O.D. split sample spoon the second and third 6-inch increments of an 18-inch distance.

CPT Cone penetration test -- results recorded as the number of blows of a 140-pound hammer falling 30 inches required to drive a 1-13/16-inch-diameter cone one foot.

SRS Split barrel ring sample 2-inches I.D. for taking undisturbed samples.

LRS Split barrel ring sampler 2.5-inches I.D. for taking undisturbed samples.

STS Shelby tube sample for taking undisturbed samples (2" to 3-5/16" I.D.).

Sack Sample of disturbed soil placed in canvas bag.

GWL Groundwater level on day of completion of field investigations.

FD In-place field density test.

CONSULTING GEOTECHNICAL ENGINEERS

Great Falls Billings Montana — Boise Pocatello Idaho — Gillette Wyoming

LOG OF EXPLORATION HOLE

PROJECT: PRELIMINARY SUBGRADE & PAVEMENT EVALUATION - 10th AVENUE SOUTH, GREAT FALLS

JOB NO.: 78-901

DRILL TYPE: SOIL Mobile B-50, 9" Hollow Auger

Asphalt ~~ROCK~~ 4" Diamond Core

DRILLED BY: D. Gray

LOGGED BY: W. Henning

REMARKS: C = Asphalt Core. S = Sack Sample. LSS = Large Splitspoon. SPT = Standard Penetration Resistance Test

HOLE NO. DH 1

SHEET 1 OF 1

LOCATION 10th Ave. S. & 2nd St. Ramp, 4' W. & 12' S. of east end of islanc

ELEVATION: TOP OF HOLE Street Surface

GROUNDWATER None

DATE: HOLE STARTED 10-2-78

HOLE COMPLETED 10-2-78

DEPTH (Feet)	LEGEND	CLASSIFICATION AND DESCRIPTION	SAMPLE SYMBOL	S.P.T. (N) (BLOWS/FT.)	MOISTURE CONTENT (%)	IN-PLACE DRY DENSITY (pcf)	L.L. %	P.I. %	GRAVEL %	SAND %	SILT %	CLAY %
0		Bituminous surfacing.	C									
0.6		FILL; Gravel, Sandy base to 3" size.	S						64	30	- 6 -	
1.0		FILL; Gravel, Sandy to 3" size, some clay, clay pocket at 1.0'-1.1'	S						73	20	- 7 -	
1.6		FILL; Clay, Silty; moist, stiff.										
1.8		Bituminous Surfacing, partially decomposed, damp.										
2.2			LSS	30	13							
3												
4			LSS	51	13		40	21	0	4	66	30
5		SHALE, Claystone; weathered, decomposed, some sandstone fragments near top, damp, stiff to very stiff.										
6			SPT	55	11							
7												
8												
9			SPT	47	12							
10.0		BOTTOM OF HOLE										

NTL 150

CONSULTING GEOTECHNICAL ENGINEERS

Great Falls Billings Montana — Boise Pocatello Idaho — Gillette Wyoming

LOG OF EXPLORATION HOLE

PROJECT: PRELIMINARY SUBGRADE & PAVEMENT EVALUATION - 10th AVENUE SOUTH, GREAT FALLS
JOB NO.: 78-901
DRILL TYPE: SOIL Mobile B-50, 9" Hollow Auger
Asphalt ~~ROCK~~ 4" Diamond Core
DRILLED BY: D. Gray
LOGGED BY: W. Henning
REMARKS: C = Asphalt Core. S = Sack Sample. LSS = Large Splitspoon. SPT = Standard Penetration Resistance Test. PS = Plastic Sack Sample

HOLE NO. DH 2
SHEET 1 OF 1
LOCATION 10th Ave. S. & 10th St. S., 10' N. & 8' W. of storm sewer inlet
ELEVATION: TOP OF HOLE Street Surfac
GROUNDWATER None
DATE: HOLE STARTED 10-2-78
HOLE COMPLETED 10-2-78

DEPTH (Feet)	LEGEND	CLASSIFICATION AND DESCRIPTION	SAMPLE SYMBOL	S.P.T. (N) (BLOWS/FT.)	MOISTURE CONTENT (%)	IN-PLACE DRY DENSITY (pcf)	L.L. %	P.I. %	GRAVEL %	SAND %	SILT %	CLAY %
0		Bituminous surfacing.	C									
0.6		FILL; Gravel, Sandy to 1/2", level-	S						52	48	- 0 -	
0.7		Bituminous surfacing, ing course.	PS		1				37	61	- 2 -	
1.1		decomposed, broken, loose.	PS		3		25	11	64	32	9	5
1.4		FILL; Gravel, Sandy to 2" size.										
1.9		FILL; Clay, Gravelly, damp, stiff.										
		FILL; Sand, Clayey, moist, medium firm.	LSS	13	13		25	10	21	45	20	14
			S				30	14	29	42	16	13
3.6												
			LSS	13	31							
5			S									
		CLAY, Plastic, moist, medium firm to stiff, salts.	LSS	27	33							
6												
7			SPT	18	27							
8												
9			SPT	15	30							
10.0		BOTTOM OF HOLE										

NTL 150

CONSULTING GEOTECHNICAL ENGINEERS

Great Falls Billings Montana — Boise Pocatello Idaho — Gillette Wyoming

LOG OF EXPLORATION HOLE

PROJECT: PRELIMINARY SUBGRADE & PAVEMENT EVALUATION - 10th AVENUE SOUTH, GREAT FALLS

JOB NO.: 78-901

DRILL TYPE: SOIL Mobile B-50, 9" Hollow Auger

Asphalt ~~ROCK~~ 4" Diamond Core

DRILLED BY: D. Gray

LOGGED BY: W. Henning

REMARKS: C = Asphalt Core. S = Sack Sample. LSS = Large Splitspoon. SPT = Standard Penetration Resistance Test. PS = Plastic Sack Sample

HOLE NO. DH 3

SHEET 1 OF 1

LOCATION 10th Ave. S. & 17th St. S., 30' W. & 12' S. of storm sewer inlet

ELEVATION: TOP OF HOLE Street Surfac

GROUNDWATER None

DATE: HOLE STARTED 10-2-78

HOLE COMPLETED 10-2-78

DEPTH (Feet)	LEGEND	CLASSIFICATION AND DESCRIPTION	SAMPLE SYMBOL	S.P.T. (N) (BLOWS/FT.)	MOISTURE CONTENT (%)	IN-PLACE DRY DENSITY (pcf)	L.L. %	P.I. %	GRAVEL %	SAND %	SILT %	CLAY %
0		Bituminous surfacing.	C									
0.3		FILL; Gravel, Sandy to 1/2" size, leveling course.	PS		12							
0.5		FILL; Gravel, Clayey, considerable sand, gravel to 2" size, moist, very compact.	S				25	11	56	28	10	6
1.5			LSS	55	5		G	NP	11	72	10	7
3		SAND, Silty; poorly graded, fine, some gravel contamination to 3', damp, dense to medium compact.	S									
4			LSS	14	11							
5												
6.1			LSS	9	16							
7		CLAY, Silty; some sand, moist, medium firm.										
7.6			SPT	7	24							
9		CLAY, Plastic; moist, firm, salts.										
			SPT	13	31							
10.0		BOTTOM OF HOLE										

NTL 150

CONSULTING GEOTECHNICAL ENGINEERS

Great Falls Billings Montana — Boise Pocatello Idaho — Gillette Wyoming

LOG OF EXPLORATION HOLE

PROJECT: PRELIMINARY SUBGRADE & PAVEMENT EVALUATION - 10th AVENUE SOUTH, GREAT FALLS

JOB NO.: 78-901

DRILL TYPE: SOIL Mobile B-50, 9" Hollow Auger

Asphalt ~~ROCK~~ 4" Diamond Core

DRILLED BY: D. Gray

LOGGED BY: W. Henning

REMARKS: C = Asphalt Core. S = Sack Sample. LSS = Large Splitspoon. SPT = Standard Penetration Resistance Test. PS = Plastic Sack Sample

HOLE NO. DH 4

SHEET 1 OF 1

LOCATION 10th Ave. S. & 26th St. S., 5' W. & 20' S. of east end of island

ELEVATION: TOP OF HOLE Street Surface

GROUNDWATER None

DATE: HOLE STARTED 10-2-78

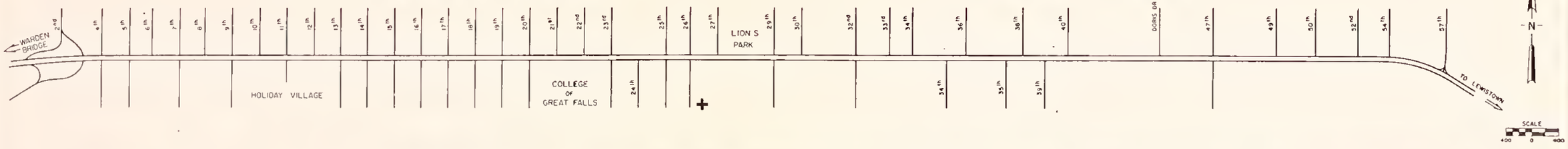
HOLE COMPLETED 10-2-78

DEPTH (Feet)	LEGEND	CLASSIFICATION AND DESCRIPTION	SAMPLE SYMBOL	S.P.T. (N) (BLOWS/FT.)	MOISTURE CONTENT (%)	IN-PLACE DRY DENSITY (pcf)	L.L. %	P.I. %	GRAVEL %	SAND %	SILT %	CLAY %
0		Bituminous surfacing.	C									
0.5		FILL; Gravel, Sandy, some clay, gravel to 2" size.	PS		5		24	9	65	25	6	4
0.7		FILL; Gravel, Sandy; considerable clay, gravel to 3" size.	S				24	9	63	19	12	6
1.5			S									
			LSS	41	6		G	NP	22	54	15	9
3		FILL; Sand, Silty; some gravel and sandstone fragments, some clay, clay lense from 3.2' to 3.5', damp, compact to loose.										
4			LSS	6	5							
5.2			LSS	50/0.4	5							
6		SANDSTONE; fractured, weathered, dry, dense.										
7												
8												
8.6		BOTTOM OF HOLE	SPT	50/0.1								

NTL 150

Data Collected October 2,1978

10TH AVENUE SOUTH - GREAT FALLS



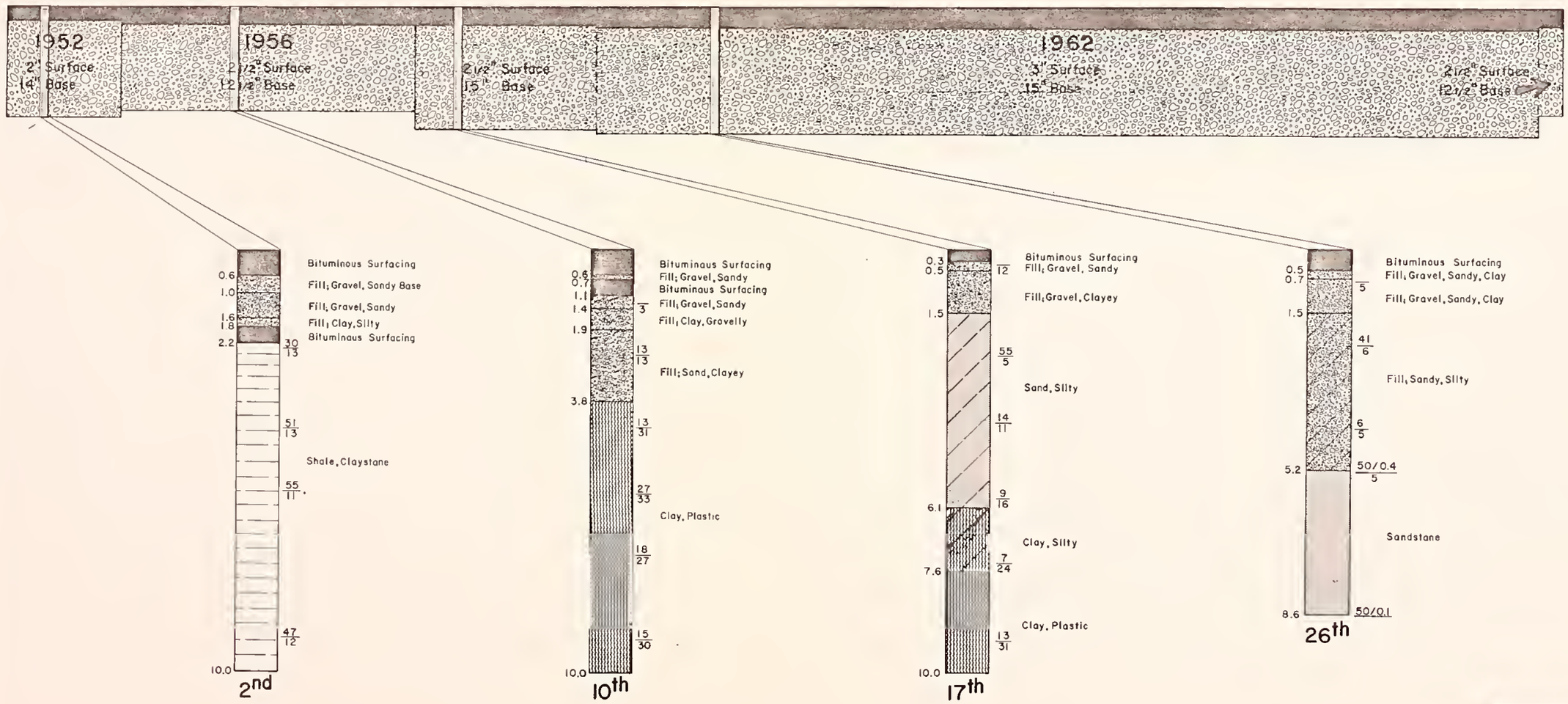


FIGURE 13

Soils Mechanics Engineering — Investigations
Construction Materials Evaluation and Testing
Construction Quality Control and Inspection
Chemical Analysis and Pollution Control Testing

Great Falls Billings Montana — Boise Pocatello Idaho — Gillette Wyomi

528 Smelter Avenue
P.O. Box 951
Great Falls, Montana 59401
(406) 453-1641

November 16, 1978

Daily-Peccia and Associates
One North Last Chance Gulch Suite 3
Helena, Montana 59601

Attention: Mr. Robert Peccia, P.E.

Subject: Preliminary Subgrade and Pavement Evaluation - 10th Avenue South Great Falls, Montana

Gentlemen:

As an addendum to our report of preliminary subgrade and pavement evaluation for 10th Avenue South in Great Falls, dated November 6, 1978, we are providing herewith preliminary portland cement pavement alternates.

Using Portland Cement Association guidelines and the provided traffic data, we have established the following pavement thicknesses:

	CBR=2	CBR=7
	Thickness, Inches	
Portland Cement Concrete	8	7

These thicknesses assume that the concrete has a minimum 28 day compressive strength of 4,000 pounds per square inch and that the pavement would be placed directly on natural subgrade. The existing base course does not appear suitable for concrete pavement (by Portland Cement Association guidelines) since it is not free draining and therefore frost susceptible. The thicknesses presented above can be manipulated using crushed base or cement treated base and drainage courses to a minimum thickness of about 6 inches. However, this thickness assumes all trucks are legally loaded and that the impact load factor is, therefore, unity.

If you have any questions or if we may be of further service, please call.

Very truly yours,

Dennis A. Williams, P.E.

DAW/kml
In duplicate

APPENDIX E

TRAFFIC SIGNAL SYSTEM EVALUATION

APPENDIX E

TRAFFIC SIGNAL SYSTEM EVALUATION

Traffic signal systems have undergone a substantial change since the advent of microprocessor units. To be familiar with the current state of the art and new equipment on the market requires a full time committment to traffic signal systems. We were fortunate to have Ed Gossack assist in the analysis and recommendations of traffic signals on Tenth Avenue South.

Ed Gossack is very familiar with the existing signal systems on Tenth Avenue South having assisted in the design of the system while with the Montana Department of Highways. Mr. Gossack is now located in Salem, Oregon where he does work on traffic systems in the States of Washington and Oregon.

Mr. Gossack's report on the traffic signal systems on Tenth Avenue South is contained in this section of the Technical Supplement.

LIST OF FIGURES

IS - Approach Service Volume

14 - Existing 80 Second Cycle-Average Time-Space Diagram.

15 - Proposed 90 Second Cycle-Average Time Space Diagram.

IVS - G/C Nomograph.

16 - System Basic 100 Second Cycle-Average Time-Space Diagram.

LIST OF TABLES

IS - Approach Volumes 1978.

IIS - Relationship of Load Factor to Level of Service.

IIIS - Highest Reported Hourly Volumes Four-Lane Divided, Two-Directional.

IVS - Bandwidth Reduction.

VS - Relationship of Speed, Cycle Length and Spacing.

VIS - Band Width Progression Speed.

VIIS - Comparison of Directional Flow Tenth Avenue South.

VIIIS - Existing Control Equipment.

HISTORY

The traffic signal control system on Tenth Avenue South was installed in 1964. The original system consisted of a TM-1 traffic adjusted master controller at 9th Street with T-517 two-phase semi-actuated traffic controllers and TM-24 coordination units, located at 2nd Street, 5th Street, 7th Street, 9th Street, 11th Street, 13th Street, 14th Street and 15th Street. G-2 Advance Green Timers were installed at the intersections at 2nd, 9th and 15th Streets to provide leading left turn movements on a fixed time basis.

The timing for the side street approaches on to Tenth Avenue was dependent on MR-10 magnetic vehicle detectors. If there were no vehicles detected or pedestrian push button actuation, the green signal would be continuously displayed on the arterial.

Subsequently, the intersections of 20th, 25th, 26th, 32nd and 49th Streets have been signalized with all but 49th Street added to the coordinated system. An advance green timer has been added to 13th Street.

Interconnection is accomplished by 10 conductor cable in underground conduit from 2nd Street to 15th Street, and via telephone interconnect to 20th, 25th, 26th and 32nd Streets.

The system is known as a traffic adjusted system. It has the ability to provide three cycle lengths with three offsets per cycle. The offsets provide either inbound progression, outbound progression or average progression on each cycle. The three cycle lengths installed are 60 seconds, 70 seconds and 80 seconds.

Selection of cycle length and offset is made by the TM-1 Master Coordinator based on volume sampling detectors on 10th Avenue and parameters set on the TM-1. These detectors are located between 9th and 10th Streets and also at 25th Street. When the volumes drop below preset parameters, the system goes to "Free" operation allowing each intersection to time independently on a semi-traffic actuated operation.

When the system was installed in 1964, 10th Avenue ADT was approximately 22,000 vehicles with the approach from the north on 9th Street having the highest side street volume of any intersection on the system. At that time the approach volumes from the South at any signalized intersection were negligible. This provided little turning friction for the side street traffic entering 10th Avenue and permitted rather short and efficient side street timing resulting in greater amount of green time alloted to 10th Avenue.

The system was set up in 1964 with 60 second, 70 second and 80 second cycle lengths with a double alternate offset for average progression. This provided a satisfactory operation at that time.

The 1977 ADT on 10th Avenue was 30,000 vehicles. The peak hour approach volume from the north at 9th Street is currently the sixth highest approach volume. This indicates a rather drastic change in the complexion on traffic movements on the arterial.

TABLE I S

APPROACH VOLUMES 1978

(Unadjusted)

INTERSECTION	DATE	APPROACH	L	T	R	TOTAL
13th	7/78	South	329	100	411	840
26th	4/78	South	357	311	168	836
9th	7/78	South	287	301	157	745
14th	3/78	North	243	189	267	699
5th	3/78	North	253	76	212	541
9th	7/78	North	182	213	115	510
15th	7/78	South	60	251	93	404

The system is currently operating with 60,70 and 80 second cycle length and double alternate offset (using a basis of 864'). With the increase of 36% in ADT and the extreme change in complexion of traffic generation onto and crossing 10th Avenue, these original settings are no longer efficient.

THEORETICAL ARTERIAL CAPACITY

A discussion of theoretical capacity of Tenth Avenue will follow. For the purposes of clarification, some terms will be defined to assist in understanding the discussion.

Capacity is the maximum number of vehicles that have a reasonable expectation of passing over a roadway in a period of time under prevailing conditions (1). These values are generally related to the possible maximum number of vehicles that can be accommodated regardless of the effect of delaying drivers and restricting their freedom to maneuver.

Level of Service is a qualitative measure that represents the collective factors of speed travel time, traffic interruptions, freedom to maneuver, safety, driving comfort and convenience, and operating costs provided by a highway facility under a particular volume condition. (1)

Service Volume is the maximum volume associated with a particular level of service. (1)

TABLE II S

RELATIONSHIP OF LOAD FACTOR TO LEVEL OF SERVICE

Level of Service	Description	Load Factor
A	Free Flow	0.0
B	Stable Flow	$\leq$ 0.1
C	Stable Flow	$\leq$ 0.3
D	Approaching Unstable Flow	$\leq$ 0.7
E	Unstable Flow	$\leq$ 1.0 *
F	Forced Flow	

*Usually 0.85 in the absence of an exceptionally effective signal progression. (1)

Load Factor is a term which pertains to signalized intersections specifically and relates to level of service. It is defined as the ratio of the number of green phases that are loaded or fully utilized to the total number of green phases available for that approach. (1) The relationship of load factor to level of service is given in Table II S.

"The capacity and service volumes that a signalized intersection can accommodate are dependent on the intersection geometrics, signal operation and traffic factors. In the first category the approach width and grades are the most critical. The existance of parking, intersection width, exit width, turning radii, and lane configuration are also important. In the second category, the proportioning of green time is the single most important factor. Cycle length, phasing and "lost time" features are somewhat less significant." (1)

The statement regarding cycle length, phasing and lost time being somewhat less significant is true within reason at isolated intersections. Cycle length and phasing become very significant when applied to a signal system where the time relationship between adjacent signalized intersections is extremely important. They have a significant effect on both the arterial and cross streets.

A rough estimate of arterial capacity can be based on a flow rate of 1000 - 1200 vehicles per hour per 10 foot width of street per hour of green time with normal turning friction. The effect of a signal which is the most restrictive device affecting capacity will reduce the flow to 600 - 800 vehicles per hour per 10 foot lane. (2)

Comparison

The following information is for comparison purposes only to provide the reader with a basis for relating volumes on 10th Avenue, South to other arterials.

TABLE III S

HIGHEST REPORTED HOURLY VOLUMES, U.S. ROADS (1961)

FOUR-LANE DIVIDED, TWO-DIRECTIONAL FACILITIES. (2)

ROUTE AND LOCATION	AVERAGE LANE WIDTH (feet)	AVERAGE VEHICLES PER HOUR PER LANE		TOTAL VOLUME BOTH DIRECTIONS ADT
		LIGHT DIRECTION	HEAVY DIRECTION	
Sepulveda Boulevard, Los Angeles	12.5	737	1,742	45,000
Wayzata Boulevard Minneapolis	14.0	420	1,431	32,145
Twenty-Seventh Ave,N.W. Miami	11.5	785	1,195	43,851
Aurora Avenue, N. Seattle	11.0	294	1,152	35,758
Charles Street Baltimore	9.8	379	1,174	

Table III S presents some interesting figures which indicate that the 1000 - 1200 vehicles per hour, per lane, per 10 Foot width can be approached. These arterials are apparently feeder type with heavy directional flow.

The arterial of 82nd Avenue in Portland, Oregon is very similar to Tenth Avenue with regard to bordering businesses and required signalization. The ADT on 82nd Avenue varies from 21,000 to 32,000 with peaking characteristics similar to the those of Tenth Avenue South. Eighty Second Avenue has four crossing arterials with ADT of 12,000 to 17,500 with numerous other signals spaced at approximately one quarter mile intervals along six miles of arterial. The arterial has two - 12 foot and two - 11 foot through lanes with one - 10 foot left turn lane on a 56 foot section curb to curb.

The basic signal spacing is 1300 feet with cycle lengths of 60 and 70 seconds currently in use. Personnel at the City of Portland have indicated that the signal spacing is too close to allow for proper cycle lengths and progression. The short cycle lengths further restrict the use and efficiency of multiphase intersections.

BASIC CAPACITY - CURRENT OPERATION

Since the most restrictive traffic control device affecting arterial capacity is the traffic signal, an analysis is presented. The volumes at 9th Street will be used as being most representative due to high demands from both north and south. Following is the peak hour analysis utilizing Figure I S which is reproduced from Transportation and Traffic Engineering Handbook. The graph with no parking was selected over the one with parking because it more nearly approximates the actual operating conditions on Tenth Avenue.

The following adjustment factors are taken from the Handbook based on July 1978 count data:

Outlying Business District -	1.25
Trucks 5%	1.00
Left Turn 5%	1.05
Right Turn 10%	1.00
Metro Population 100,000 and Peak Hour Factor 0.90	0.98

Width of approach is 32 feet and the cycle split is 50% at 80 second cycle time. The split yields a green to cycle length ratio of 36/80 or 0.45.

With the peak hour highest approach volume of 1,555 vehicles on the arterial set equal to the adjusted service volume, the basic service volume is obtained from the following formula:

$$\text{Basic Service Volume (1)} = \frac{\text{Adjusted Service Volume}}{\text{G/C (Product of Adjustment Factors)}}$$

$$\text{BSV} = \frac{1555}{0.45\ (1.25 \times 0.95 \times 1.05 \times 1.00 \times 0.98)}$$

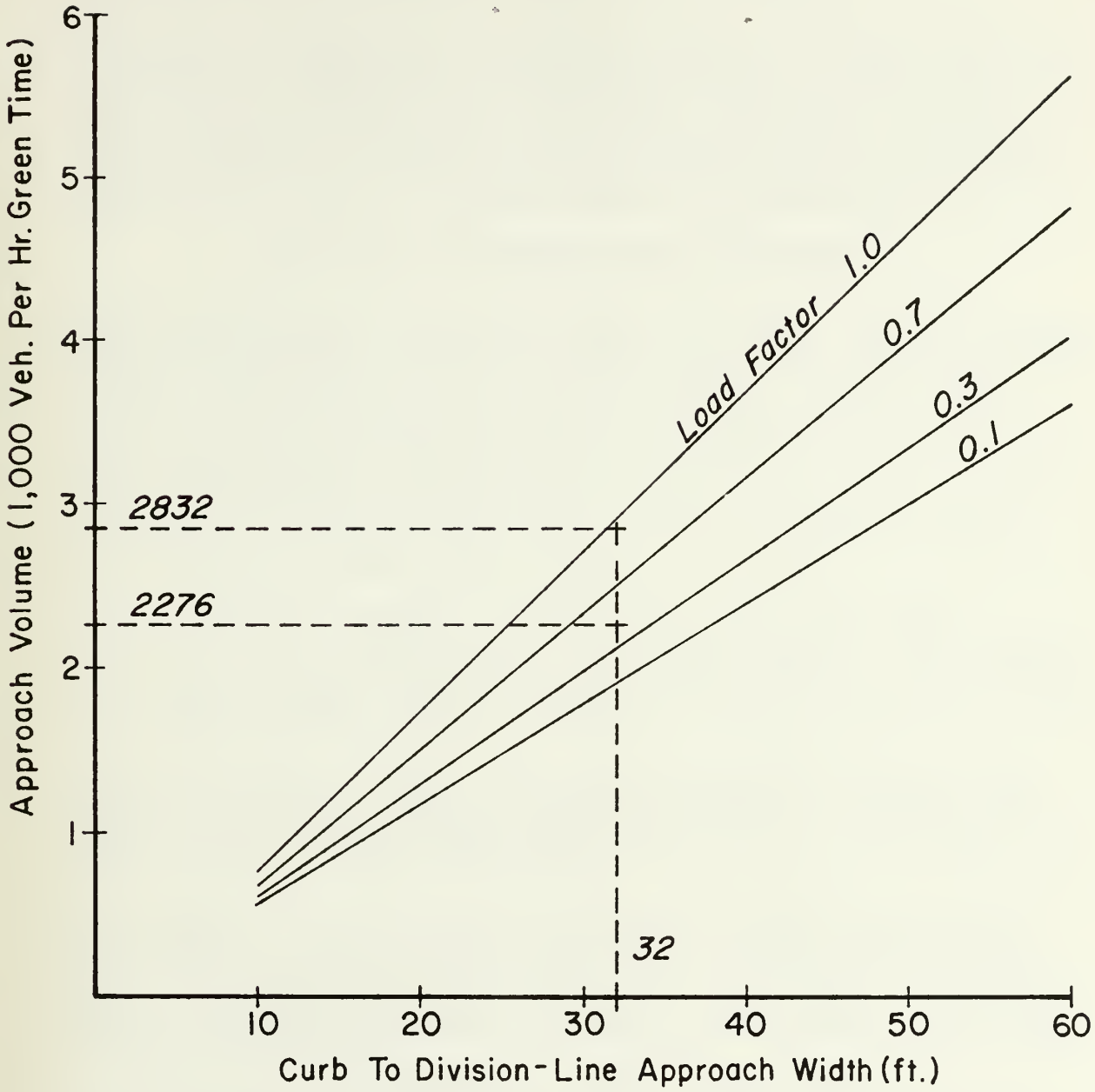
$$\text{BSV} = 2832 \text{ Vehicles Per Hour}$$

Entering this number on Figure I S as approach volume and projecting across until it intersects 32 foot width indicates a load factor of 1.0. Referring to Table II S indicates that Level of Service "E" is reached during peak hour under current conditions.

To end this discussion on theoretical capacity, a quote from Transportation and Traffic Engineering Handbook should be made.

"Although highway capacity and service volumes have been studied for nearly 50 years, many questions remain unanswered. The analysis methods reported herein are adequate for gross examination but seldom provide the knowledgeable user with a complete sense of ease when a precise answer is required. In no area is this more true then with signalized intersections. The complexity of factors involved and the inherent variability of the traffic phenomenon have thus far limited both theoretical and empirical approaches to precise solution..." (1)

Figure IS



Urban intersection approach service volumes in vehicles per hour of green signal time for two way streets with no parking.

The statement above regarding signalized intersections refers to isolated intersections. To attempt to relate this to a coordinated system is exceedingly more difficult.

The capacity analysis at signalized intersections are made on a basis of fixed time controller operation. Fully actuated control tends to more nearly load each green interval and will result in an increase in capacity. Further, coordinated systems designed to keep traffic moving continously through intersections, yield somewhat higher capacities than isolated signals or a series of signals without coordination. (3)

ANALYSIS OF EXISTING SYSTEM OPERATION

The TM-1 Master Controller has the capability of selecting three cycle lengths and three offsets per cycle, based on sampled volume of traffic. The three cycle lengths currently installed are 60, 70 and 80 seconds. During periods of light traffic volumes a traffic adjusted system will operate in a "Free" mode allowing each intersection to time independently. During volume build-up and off peak daytime operation a system would operate at the short cycle length. Any intermediate level of volume would call the second cycle length and the peak hours would call the longest cycle length into effect.

When the traffic volumes on Tenth Avenue were at 22,000 - 23,000 ADT, the 60 second cycle would be in effect from approximately 6:30 A.M. until 11:30 A.M. at which time it would switch to 70 second cycle. The 80 second cycle would only be in effect from about 4:30 P.M. until 6:00 P.M.

With the current traffic volumes of 30,000 ADT, the same cycle lengths are in use. Due to the 36% increase in volume, the system reaches the 80 second cycle by 7:30 A.M. and remains in effect until approximately 6:00 p.m.

Figure 14 is a time space diagram depicting the band widths of 35 MPH for each direction of travel on Tenth Avenue South. This is the 80 second cycle and average progression settings which currently operate throughout most of the day as mentioned above. The existing offsets are double alternate with a basic distance of 864 feet.

To determine the required cycle length and type of alternate system to provide a 35 MPH progression speed for the two-way operation, the following calculations were made:

Basic Signal Spacing - 864 Feet
35 MPH = 51.33 Feet/Second
Time to travel between signals = 16.8 Seconds
Round Trip Time
- 1st Signal - 33.6 Seconds
- 2nd Signal - 67.2 Seconds
- 3rd Signal - 100.8 Seconds

A double alternate system with either 65 second or 70 second gear would provide approximately 35 MPH two-way progression. A triple alternate system with 100 second cycle gear would also provide a 35 MPH progression.

It has previously been demonstrated that the 80 second cycle length provided a Level of Service "E" during peak hours. Therefore, 100 second cycle operation and triple alternate appears to provide the most optimum progression speed by substituting 56/100 or 0.56 for the new G/C ratio into the Basic Service Volume formula, a value of 2276 vehicles per hour is derived. When this value is tested in Figure I S it is found that the system would be operating between a Load Factor of 0.3 and 0.7. This would be between Level of Service "C" and "D" for peak hour operation.

The City of Great Falls currently has a supply of 90 second gears available for the coordination units. Figure 15 is a time space diagram demonstrating possible improvement of progressive flow at 35 MPH by utilizing these gears and changing to a triple alternate offset. This can be an immediate improvement accomplished by the expenditure of approximately 1/2 man hours per signal location.

Figures 14 and 15 present the area of Tenth Avenue South from 2nd Street to 15th Street because of the greater density of signals. This can be applied throughout the entire system.

PROPOSED SYSTEM DEVELOPMENT

The relative efficiency of a two-way progressive signal system is dependent on the distances between signalized intersections, the speed of traffic, roadway capacity, friction caused by turning vehicles, parking maneuvers and pedestrians. In general, a two-way progression with maximum band widths can only be achieved if the signal spacings are such that vehicular travel times between signals are multiple of one-half the common cycle length; otherwide inevitable compromises have to be made in the progression design. (1)

To obtain maximum efficiency of a system the goal is to select the shortest cycle length which will accommodate the traffic demands at a Level of Service desired. This will also keep the delay on the side streets to a minimum. A system established with maximum band widths will achieve this goal. Maximum band widths are obtained by a single alternate system. A double alternate system reduces through band widths to 50% of available arterial green time and a triple alternate system reduces the band width to 33% of available arterial green time.

To develop an optimum operation at 35 MPH, the traffic volumes at 9th Street are used as before along with Figure IV S.

10th AVENUE SOUTH

THROUGH BAND COMPARISON

AT SPEED LIMIT (35 MPH)

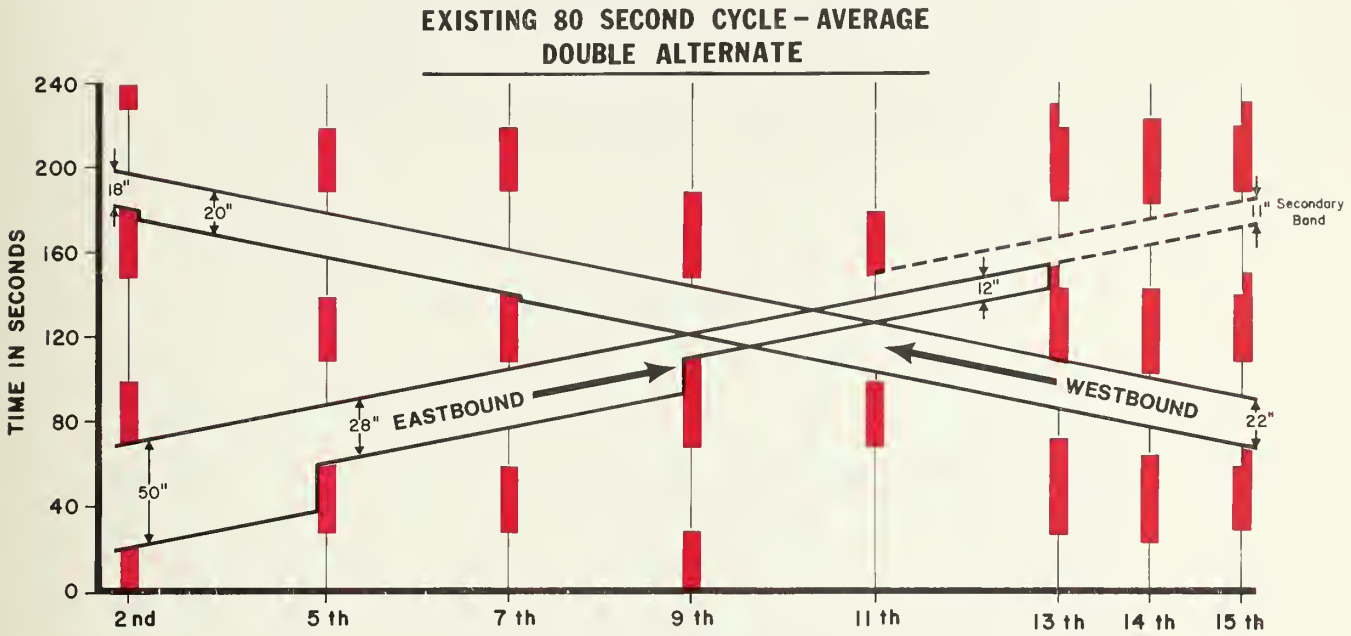


FIGURE 14

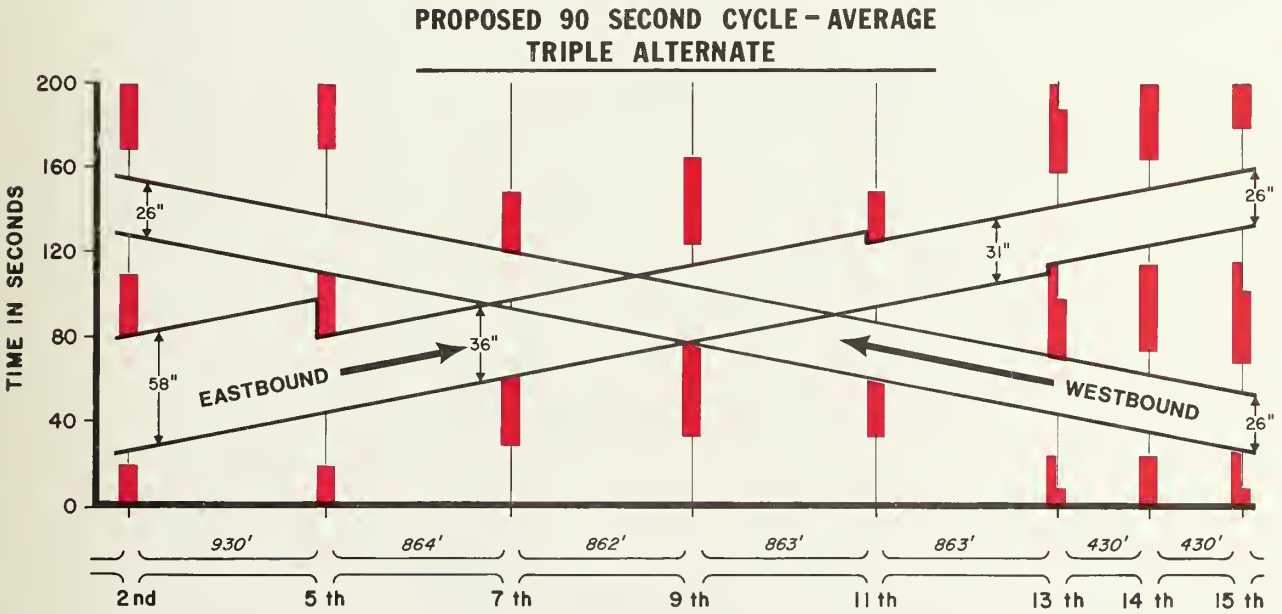


FIGURE 15

10th AVENUE SOUTH

100 SECOND CYCLE – AVERAGE PROGRESSION

NOTES:

1. Progression speed is 35 m.p.h. for 100% of bandwidth except transition area.
2. Transition between 15th Street and 20th Street produces 29 m.p.h. for 100% of bandwidth.
3. Maximum allowable cross street time without reducing bandwidth is also shown for other than key locations

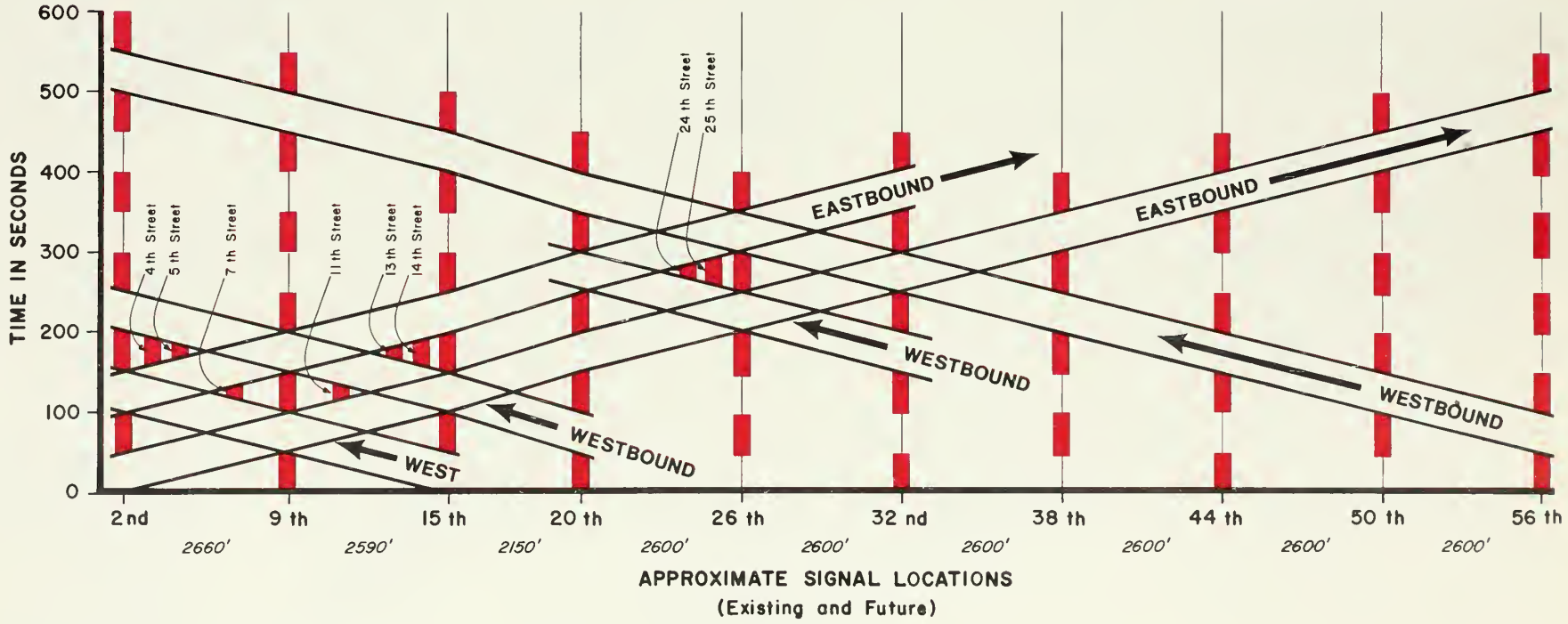
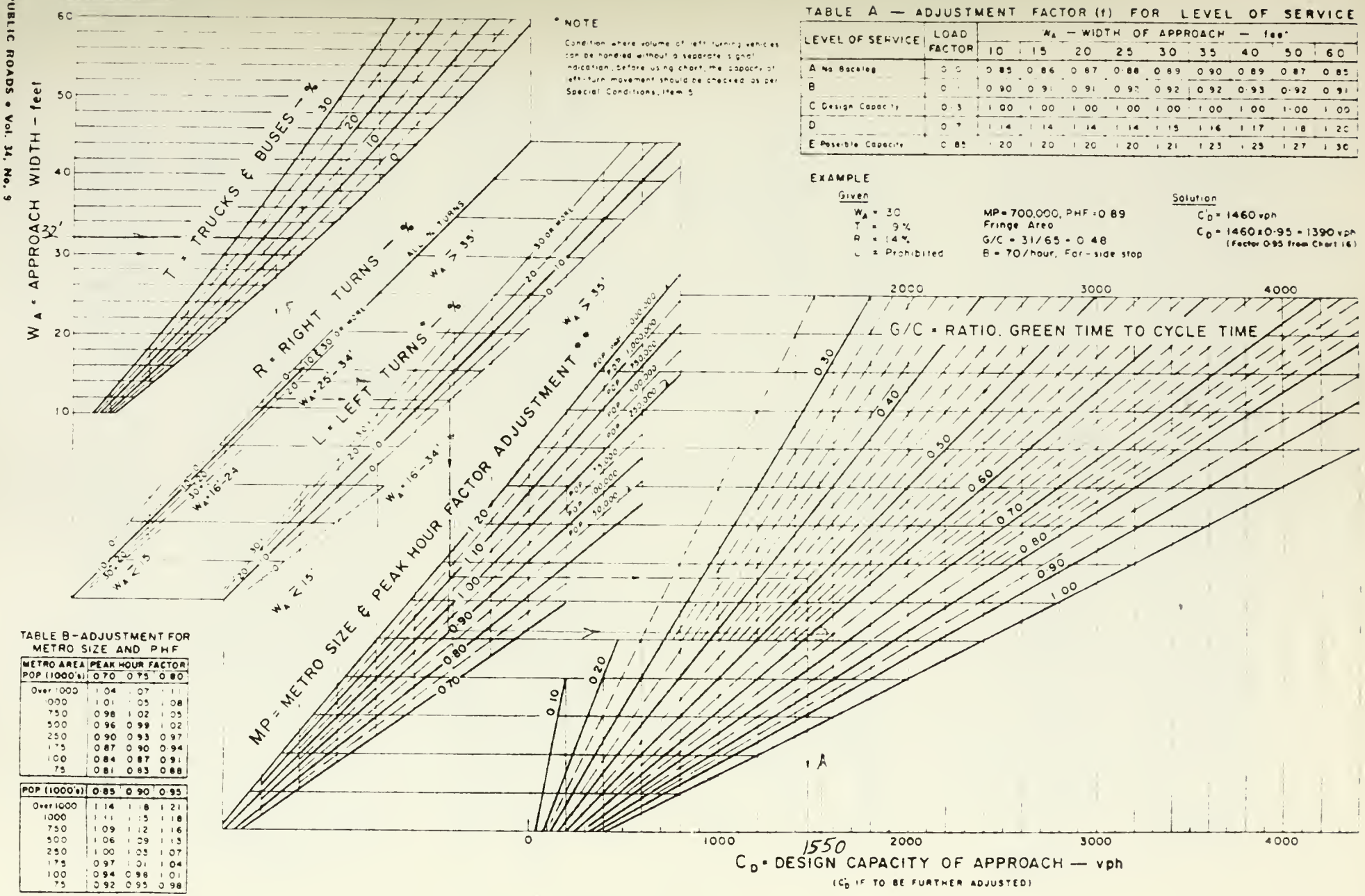


FIGURE 16

FIGURE IV S - G/C NOMOGRAPH



* NOTE

Condition where volume of left turning vehicles can be handled without a separate signal indication. Before using chart, the capacity of left-turn movement should be checked as per Special Conditions, Item 5.

TABLE A — ADJUSTMENT FACTOR (f) FOR LEVEL OF SERVICE

LEVEL OF SERVICE	LOAD FACTOR	W_A — WIDTH OF APPROACH — feet*								
		10	15	20	25	30	35	40	50	60
A No Backup	0.0	0.85	0.86	0.87	0.88	0.89	0.90	0.89	0.87	0.85
B	0.1	0.90	0.91	0.91	0.92	0.92	0.92	0.93	0.92	0.91
C Design Capacity	0.3	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
D	0.7	1.14	1.14	1.14	1.14	1.15	1.16	1.17	1.18	1.20
E Possible Capacity	0.85	1.20	1.20	1.20	1.20	1.21	1.23	1.25	1.27	1.30

EXAMPLE

Given

W_A = 30
T = 9%
R = 14%
L = Prohibited

MP = 700,000, PHF = 0.89
Fringe Area
G/C = 31/65 = 0.48
B = 70/hour, For-side stop

Solution

C'_D = 1460 vph
C_D = 1460 x 0.95 = 1390 vph
(Factor 0.95 from Chart 16)

TABLE B - ADJUSTMENT FOR METRO SIZE AND PHF

METRO AREA POP (1000's)	PEAK HOUR FACTOR 0.70	0.75	0.80
Over 1000	1.04	1.07	1.11
1000	1.01	1.05	1.08
750	0.98	1.02	1.05
500	0.96	0.99	1.02
250	0.90	0.93	0.97
175	0.87	0.90	0.94
100	0.84	0.87	0.91
75	0.81	0.83	0.88

POP (1000's)	0.85	0.90	0.95
Over 1000	1.14	1.18	1.21
1000	1.11	1.15	1.18
750	1.09	1.12	1.16
500	1.06	1.09	1.13
250	1.00	1.03	1.07
175	0.97	1.01	1.04
100	0.94	0.98	1.01
75	0.92	0.95	0.98

** Use Table B if PHF is known to find adjust factor, otherwise use Population directly

DESIGN CAPACITY OF SIGNALIZED INTERSECTIONS

TWO-WAY STREET — NO PARKING — O.B.D., FRINGE & RESIDENTIAL AREAS

FRNG. O.B.D. RES.

4

CHART 4

Figure IV S which is extracted from Public Roads, Vol 34, No. 9, is used to determine the G/C ratio required to handle 1550 vehicles on the arterial at Level of Service "C". For this calculation the amber time is included with green time which provides no significant error. The required green plus amber for 9th Street approaches is taken to be 40 second.

Proceeding through the nomograph of Figure IV S until the vertical line at 1550 vehicles is intersected gives a G/C ratio of 0.6 for the arterial. Since (G + 40) equal cycle length (6) it is found that a 100 second cycle will provide a satisfactory G/C ratio for current volumes.

TABLE IV S

BAND WIDTH REDUCTION

EFFECT OF SIGNAL DISPLACEMENT FROM OPTIMUM LOCATION

Distance From Optimum Location (Feet)	Band Width Reduction One Direction (Seconds)	Total Reduction Both Directions (Seconds)
433	8.4	16.8
867	16.8	33.6
1300	25.2	50.4

To obtain maximum band width therefore the optimum signal spacing is desired speed (ft/sec) X 1/2 cycle length (Sec) or 51.33 X 50 = 2566 feet. Figure 16 is a time space diagram developed using a basic signal spacing of 2600 feet, speed of 35 MPH and cycle length of 100 seconds. A split of 50% is shown for simplification. It was previously determined that a 60/40 split is necessary to accomodate the current arterial ADT.

This basic spacing of 2600 feet adopts very nicely to Tenth Avenue South block spacing. Signals placed at 2nd, 9th, 15th, 21st, 27th, etc., at 2600 foot intervals therefore provides optimum signal spacing. The effect of signals placed one block on either side of these key intersections theoretically reduce each band width by 8.4 seconds or 16.8 seconds total both directions. Table IV S gives the band width reduction for signals located one, two and three block lengths from optimum location at 35 MPH, assuming that they require the same split as the key intersections.

Improperly located signals can severely affect traffic flow on an arterial. It is realized, however, that optimum spacing cannot always be adhered to, but must definitely be attempted.

Distance from optimum location and amount of total time the side street requires are interrelated. To minimize the effect of poor signal locations, it is necessary to decrease the amount of time available at key intersections to the cross street at a rate of $\frac{2X \text{ Distance from Optimum (feet)}}{\text{Desired Travel Speed (Ft/Sec)}}$ for the displaced location. Methods of decreasing required cross street timing is discussed later in this report.

Table V S was developed from the formula S(MPH) = D(FT) ÷ 0.735 C(sec) by substituting various values for desired speed and desired cycle length. The results are the optimum signal spacings in feet to provide maximum band widths for two-way progression.

TABLE V S

RELATIONSHIP OF SPEED, CYCLE LENGTH, AND SPACING

Two-Way Progression

Desired Cycle Length (secs.)	Desired Speed (MPH) 25	30	35	40	45
60	1102	1323	1544	1764	1985
70	1286	1544	1800	2058	2315
Minimum Cycle Length					
80	1470	1764	2058	2352	2646
90	1654	1985	2315	2646	2977
100	1838	2205	2573	2940	3308
110	2021	2423	2830	3234	3638
120	2205	2646	3087	3528	3969

The area marked on the table is the optimum spacing of 2600 determined previously ± one block.

Using a block spacing of 432 feet and the same formula above, Table VI S was developed showing progression band speed related to cycle length and signal spacing.

TABLE VI S

BAND WIDTH PROGRESSION SPEED

RELATIONSHIP OF SIGNAL SPACING AND CYCLE LENGTH

Cycle Length (secs)	Number of Blocks Between Signals				
	2	3	4	5	6
60	19.6	29.4	39.2	49.0	58.8
70	16.8	25.2	33.6	42.0	54.0
Minmum Cycle Length					
80	14.7	22.0	29.4	36.7	44.1
90	---	19.6	26.1	32.7	39.2
100	---	17.6	23.5	29.4	35.3
110	---	16.0	21.4	26.7	32.1
120	---	14.7	19.6	24.5	29.4

The area within the dashed lines provide a range of band width speeds that can be workable in the system. A cycle length of 80 seconds is the minimum cycle length which should be used when the number of phases exceed two or three phase with light demand.

It can be seen in Table VI S that the six block spacing provides a wide range of cycle lengths for use. This will allow for the maximum flexibility in timing and coordination in the future.

DIRECTION FLOW

Table VII S is a sampling of through traffic volumes at a number of intersections. The counts used were various days and various months to determine if there is any uniformity in traffic patterns.

The table shows that there is a large amount of generation and dispersal throughout the system. There are definite areas requiring preferential offsets in one direction or the other. The need for dynamic real time system control is readily apparent.

TABLE VII S

COMPARISON OF DIRECTIONAL FLOW

MORNING AND AFTERNOON PEAK PERIODS

	A M			P M		
Street	Westbound	Eastbound	(%)	Westbound	Eastbound	(%)
2nd	766	1141	(67)	1043	686	(66)
5th	1270	1860	(68)	1143	1045	(91)
7th	1475	1690	(87)	1248	1388	(90)
9th	1521	1734	(88)	1058	1297	(82)
13th	1616	1712	(94)	1011	1405	(72)
15th	1546	1751	(88)	1032	1722	(60)
23rd	2470	1804	(73)	1429	1575	(91)
26th	1602	2116	(76)	1066	1572	(68)
32nd	1036	949	(92)	933	1044	(89)
49th	771	930	(83)	652	819	(80)

Note: AM volumes are 2 hour counts (7 A.M. - 9 A.M.).

PM volumes are 1 hour counts (Peak Hour).

Volumes are through traffic only.

(%) is differential of flow.

EXISTING CONTROL EQUIPMENT

Table VIII S is a listing of the existing signal control equipment at the various streets along 10th Avenue South.

TABLE VIII S

EXISTINC CONTROL EQUIPMENT

Location	Controller	Coordinator	Advance Green Timer
2nd	T-517	TM-24	G2
5th	T-517	TM-24	
7th	EMC4000	TM-24	*
9th	T-517	TM-1	G2
11th	T-517	TM-24	
13th	T-517	TM-24	G2
14th	T-517	TM-24	
15th	T-517	TM-24	G2
20th	D2000	C11000	
25th	D2000	C11000	
26th	D4000	C11000	*
32nd	D2000	C11000	
49th	D2000	None	

Description	
T-517	Two phase semi-actuated controller
EMC4000	Four phase solid state NEMA controller
D2000	Two phase solid state controller
D4000	Four phase solid state controller
TM-24	Electro-mechanical local coordinator
TM-1	Electro-mechanical master coordinator
C11000	Electro-mechanical local coordinator
G2	Advance green timer
*	Leading left turns are provided by one phase of controller

The T-517 Controller has the capability of timing two phases with only one of the phases being actuated. To provide for separate left turn movements, G2 Timers had to be included. The G2 Timer does not provide for a yellow clearance following the leading left turn arrows. This is extremely unsafe and further does not comply with the Manual on Uniform Traffic Control Devices.

The control equipment at 2nd , 9th, 13th and 15th should be replaced immediately from a liability standpoint without associating it with a possible new system project. New equipment installed at these locations on Tenth Avenue would be useable at other locations should they not be totally compatible with a new system. The replacement equipment should be full traffic actuated.

The electro-mechanical coordination equipment does not provide the accuracy or have the functional capability to efficiently control the traffic on this arterial. Also being that it is electro-mechanical it is subject to failure at a high rate.

The D2000 and D4000 controllers are very reliable solid state controllers but do not possess a number of functions as defined by NEMA 1976 specifications. The EMC4000 is a NEMA compatible controller and may possibly be used in the new system. Extensive cabinet rewire would have to be done however.

INTERSECTION ANALYSES

2nd STREET AT WARDEN BRIDGE

It must be realized that the Warden Bridge provides a constriction which affects Westbound traffic on Tenth Avenue most severely. Vehicles utilize the inside lane almost exclusively beginning at 7th Street. This severely reduces the capacity of the arterial and cannot significantly be improved until the capacity of the bridge is increased.

The effect of opening the new 6th Street Northwest Bypass Bridge should reduce some of the demand across the Warden Bridge. Any other traffic engineering improvements which can be made on the route from the Fox Farm Road area to the City Center will tend to shunt traffic away from the Warden Bridge.

The ramp from 2nd Street joining 10th Avenue at the throat of the Warden Bridge results in an inadequate merge distance. This is a source of friction causing delays in the westbound traffic. Closing this ramp, causing the south to north traffic on 2nd Street to use the signalized intersection at 2nd Street, will provide a merge distance of greater than 750 feet. The greater merge distance willfacilitate a more orderly merging of vehicles which will result in a more uniform speed and improve actual capacity at the bridge. It may also cause two additional secondary benefits, one being a queuing of eastbound traffic at the beginning of the signal system. The other would be some utilization of the outside lane westbound by driver realization that they

do not have to compete with vehicles merging at the bridge throat.

2nd Street

A dual ring controller capable of providing future left turn phasing for all left turns should be installed at 2nd Street.

5th Street

Since 5th Street is two blocks from a key intersection and currently needs signalization due to being a portion of the couplet, the best that can be done here is to minimize the amount of green time it requires. This can be accomplished by:

1. Attracting as many vehicles as possible to the key intersections of 2nd Street preferably or to 9th Street.

2. Continue 5th Street as one-way south of 10th Avenue thereby reducing friction from opposite direction which will enable the southbound vehicles to clear faster. This will result in a larger green band on 10th Avenue.

3. Provide a four lane approach from the North. The lanes to be designated right only, right and through, left and through, and left only.

4th, 5th and 6th Streets

With the increase of traffic generators south of the arterial in this area which will require access onto or across 10th Avenue the following alternate is proposed which corresponds to the approach of keeping additional signals not at key locations as close as possible to the key intersections.

Move the existing 5th -6th Street one-way couplet one block to the West making 4th Street one-way southbound and 5th Street one-way northbound. This would eliminate the need to signalize 6th Street which would be absolutely disastrous to any progressive flow on the arterial. Refer to Table IV S.

The couplet should be designed to accomodate four lanes approaching the arterial to allow for dual left and right turns. This is necessary to keep side street time requirements to a minimum since this couplet is not at a key location. Again referring to Table IV S, it is more essential at 5th Street than at 4th Street.

Three phase controllers should be installed at 4th and 5th Streets.

7th Street

This signal should be removed.

9th Street

The key intersection of 9th Street requires a dual ring controller operating with eight phases. Widening of 9th Street to provide a minimum of five lanes on both north and south of 10th Avenue for an adequate distance to provide proper transition and usage should be accomplished.

11th Street

Eleventh Street signal should be removed.

13th, 14th and 15th Streets

The signalization at 13th, 14th and 15th Streets will continue to be the most restrictive area on the arterial. The greatest reason for this is the high side street demands at one and two blocks from the key intersection of 15th Street.

13th Street

The signal at 13th Street has a very high demand from the South as well as a high west to south left turn demand from the arterial. As is the case with 5th Street, everything possible to decrease the required timing to accomodate these vehicles should be accomplished. This would include the following recommendations:

1. Continue the 14th and 15th Street couplet to 12th Avenue South and provide good access between the couplet and the shopping center along 11th and 12th Avenue South to attract as many vehicles as possible toward the key intersection location.

2. 13th Street should be made one-way Northbound from 10th Avenue to 9th Avenue to eliminate all conflicts for northbound and turning vehicles entering 10th Avenue and to permit double left turns.

3. Provide a 3 lane approach on 13th Street designated as left only, through and left only, and right only.

4. The signal controller should be four phases. The right turn lane from the south should have an overlap indication with the west to south left turn from the arterial.

5. The left turn from the arterial should be a lagging movement for current operation but should have capabilities of changing from lag to lead depending upon program in effect as will be discussed later

6. The pedestrian movement across 10th Avenue should only be allowed on the west side of the intersection. To keep timing as efficiently as possible and to avoid conflicts with left turning traffic it is necessary to have the pedestrian phase be separate When a pedestrian call is answered, the West to South left turn shall be given a green light and the Westbound overlap signal shall display a red. It shall be necessary to skip the controller phase timing of the left turn during that cycle.

14th Street

The signal at 14th Street should be three phases also with a West to South left turn movement added to attract some of this demand away from 13th Street. The associated westbound through movement should be overlapped with the left turn. The left turn from the arterial should be a lagging movement currently.

15th Street

The east to north left turn from 10th Avenue is extermely heavy. A double left turn movement should be established to efficiently accomodate the demand.

The approach from the south should be one-way as discussed earlier. Three lanes are required to allow the right turn vehicles to separate from the heavy through movement which requires two lanes.

The controller phasing would be three phases.

20th Street

This signal location presents a problem for eastbound vehicles during winter driving conditions due to the 5.4% grade. For this reason a west to south left turn should not be installed in the future.

Fifteenth Street to 20th Street is a transitional area from the original six block or approximate 2600 foot spacing of key signal intersections. This appears to be necessary due to the great demand at 26th Street.

23rd Street

A signal at this location, however inviting, would prove to be disastrous to arterial flow. This applies to any intersection which is half way between key signal locations.

25th and 26th Street One-way System

When a one-way couplet would normally terminate at a major cross arterial, it is usually desirable to extend the couplet one block beyond the arterial.(1) With the heavy generation from the Deaconess hospital, this particularly applies.

To relieve the extreme demands from arterial green time at 26th the following recommendations are made:

1. Disperse the volume generated in the hospital area by:

   A. Making 11th Avenue South a through street from 24th Street to 32nd Street.

   B. Obtain hospital staff cooperation in utilizing alternate routes.

   C. Use trail blazer signs directing traffic to alternate routes.

2. Provide four lanes for the approach from the south-left turn, through and left, through only and right turn only.

3. Provide double left turn lanes foreast to north left turn from the arterial.

4. Install a two phase controller at 24th Street and provide double left turn lanes for the north to west movement. (It is absolutely essential that the cross street green time be kept to a minimum as derived from time space diagrams.)

The controllers at 25th Street and 26th Street should be four phases in a dual ring configuration to obtain maximum efficiency.

A lagging left turn would be utilized normally at 25th Street for west to south traffic.

A lagging left turn would be utilized normally at 26th Street for east to west traffic.

29th Street

This intersection should not be signalized.

32nd Street

This street should be realigned to avoid conflicts of north and south left turn movements which will permit more efficient timing when the volumes increase. Optimumly the street should be wide enough to accomodate three approach lanes and two lanes in the opposite direction.

This intersection should be designed to attract extensive usage. The controller should be a full eight phases in a dual ring configuration.

38th Street

This street should also be realigned and improved as discussed at 32nd Street.

General

It is extremely desirable to have well designed intersections at optimum locations for movement of arterial traffic. If this is accomplished prior to high cross street demand the proper patterns and planning can be developed.

The remaining key intersections spaced at approximately 2600 feet should become a portion of a master plan. Right of way of sufficient width to develop intersections as described for 32nd Street should be retained or acquired.

The key signal locations should be incorporated in the decision making process of major north-south through streets.

SYSTEMS - STATE OF THE ART

There has been an extensive amount of development work on computer systems in the past ten years. With the development of the minicomputer and the microprocessor in recent years, computerized traffic control has become an affordable reality.

Computerized traffic control systems consists of a number of elements. The very basic elements are 1. Control computer hardware, 2. Computer Software, 3. Communications, 4. Local Controllers.

Computer Hardware

The central computer hardware requires a controlled environment location. This would be a reasonably dust free area with air-conditioning. A minimum of 100 square feet is generally required.

Computer Software

Computer software is very time consuming and costly to develop. Off the shelf programs are readily available however. To assure a completely debugged program, one that has been in actual satisfactory use for a minimum of two years would provide reasonable assurance.

The computer package and communications should be designed for full feedback from each intersection to provide surveillance of both traffic and equipment.

Communications

To obtain the most flexibility and versitility of a system, it is essential that a great amount of information be transmitted to and from the intersections. This makes communications a very critical element. Speed of transmission, type of modulation and error rate have to be considered.

For traffic control application, frequency shift keying (FSK) and phase shift keying (PSK) modulation at a rate less than 1800 band are the most satisfactory. FSK has the advantage of simpler hardware thereby making it less prone to failure. It has the following additional advantages when used at 1200 band rate.

1. Circuits easily obtainable from Telephone Company.
2. Easy to amplify.
3. Very noise immune.
4. Highly versitile with digital control.
5. Not amplitude sensitive - requiring adjustment.

Local Controllers

Microprocessor based digital controllers are available and field proven for local control operations. Some of this type of equipment is designed to also be used in system operation with no specific additional programming necessary.

The microprocessor controller is extremely versitile and can provide such features as changing phase sequence from leading left turn movements to lagging left turn movements by command. This particular feature would be extremely useful for intersections such as 15th and 26th Streets where very high left turn demand exists at key locations, or at 13th Street where a medium demand exists and is not at a key location with regard to progression. These type features provide the capability to optimize signal progression by innovative engineering.

The following elements are essential for a computerized system to control traffic effectively especially in areas of severe congestion. They provide the features for on-line real time control.

System Sampling Detectors

These detectors will provide information for the computer to determine which program to select. These detectors must be located properly to provide timely information to the computer. It is essential that the computer program uses both volume and occupancy information from the samplers to select programs. If only volume is used the system could breakdown under heavy traffic or improper progression which would give an indication of low volume when the exact opposite exists. If only occupancy information is used, light traffic moving at a good rate of speed does not give satisfactory information to select programs, therefore, the ability to use both volume and occupancy information is essential to good traffic control.

Display

With full feedback mentioned above surveillance of both traffic and equipment is facilitated. An intersection layout can then be used to display all red-yellow-green, walk-don't walk lights as well as vehicle and pedestrian detection at any one intersection at a time.

Teletype/Printer

A teletype will provide a hard copy of any equipment failures any timing, program, parameter changes. It can also provide copies of traffic counts when this is a part of the software program which is a very effective tool for system operation analysis.

Map Display

This would be very useful to the traffic engineer to provide a display of the entire system at one time for analytical purposes. It would also provide information at a glance if any intersection is dropped from computer control, thereby receiving immediate information that a local intersection is malfunctioning.

Portable CRT

Some computer systems have the ability to respond to a portable cathode ray tube with a keyboard. This can be a very useful maintenance tool. If the central computer is located remote from the maintenance personnel as is generally the case and a trouble call is reported, the computer can be called from any telephone and connected to the portable CRT. Any display information available at the master computer is then available on the portable CRT. Any function such as recalling a phase, changing time, or flashing an intersection for examples, can be done from any telephone.

Intersection Telephones

A telephone located in each controller cabinet to provide communication from the intersection to the master computer and between intersections is a very inexpensive maintenance tool.

Master systems are available which can control a number of zones simultaneously where zone is defined as an area with unique traffic patterns. Examples of zones in Great Falls would be the CBD, Tenth Ave South, Central Avenue West etc. A modular approach can be taken such as master control equipment necessary for Tenth Avenue South initially with approximately fifteen intersections. Later modules to provide for control of Central Avenue West can be added and controlled with the same master computer.

It is necessary that the computer software be able to control arterial traffic as well as CBD or grid operation traffic. This will provide a very versitile master for future development.

When bidding a computer system it is very advisable to require total system responsibility. That is, one supplier is responsible for the central computer, communications equipment, local controllers and software operating as a complete system.

ESTIMATE

An estimate for this type of an approach as applied to Tenth Avenue South initially is as follows:

Master Computer installed in space at Civic Center -	$80,000
Intersection average installed cost-all new equipment per each-	$30,000
Interconnect - Customer owned lines -	$40,000
Module addition to Master per 15 added intersections	$ 8,000

REFERENCES

1. Transportation and Traffic Engineering Handbook 1976.

2. Capacities and Limitations of Urban Transportation Modes - ITE 1965

3. Public Roads, Vol. 34, No 9, 1967.

APPENDIX F

REPORT FROM

COMMUNITY BEAUTIFICATION ASSOCIATION

APPENDIX F

REPORT FROM COMMUNITY BEAUTIFICATION ASSOCIATION

The Great Falls Community Beautification Association has expressed a lot of interest in the Tenth Avenue South Project. Part of this interest is due to the fact that the Beautification Association has a pilot beautification project located on one of the medians on Tenth Avenue South. Additional interest has been generated because of the business activity and traffic volumes associated with this arterial.

A presentation was made by the Consultant to the Beautification Committee describing alternatives for landscaping concepts. The Community Beautification Committee responded with a letter describing their views and preferences. The letter from the Community Beautification Association is reproduced in this section.

December 9, 1978

Loy Ann P. Rembe (Mrs. R. Karl)
905 Park Garden Road
Great Falls, Montana 59404

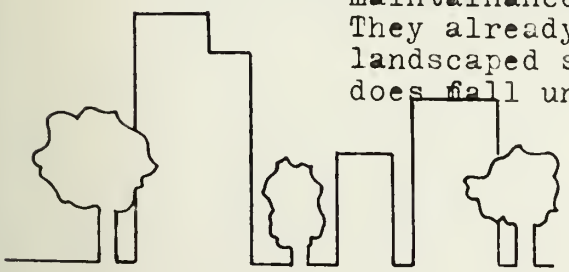
Daily Peccia & Associates
1 North Last Chance Gulch
Helena, Montana 59601

Dear Mr. Peccia,

I would like to take this opportunity to thank-you for presenting your views of 10th Avenue South beautification to the Community Beautification Asso. last Wednesday morning Dec. 6th.

As a result of your briefing and the collective thoughts of our Association, we would like to propose that three definative points concerning beautification be included in your study. They are as follows:

1. MEDIANS: We support the landscaping of all medians between 2nd Street and 57th Street as follows:
   A. All the medians having a width greater than 4' be landscaped using "Live" vegetation with underground sprinkling.
   B. All the medians 4' wide or less be landscaped using a combination of the several alternatives you proposed, i.e., cobblestone, brick, sculptured rock, shrubs, etc., again with an on-site sprinkler system where applicable.
2. BOULEVARDS: We support the landscaping of all boulevard areas within the available right-of-way and in instances where public lands exist along roadside compatible for beautification, we feel it vital for the City & State to preserve these for that. We realize the design will be contingent upon available areas, sidewalk & bikeway demands, motorist accessability, etc. Other benefits of such landscaping, in addition to beautification per say, are to assist in controlling encroachment from adjoining property owners and to better deliniate driveways.
3. MAINTAINANCE: Maintainance is an important consideration, both for the roadway and the landscaping, and cannot be taken lightly. We offer three alternatives for your review:
   A. The Montana Highway Department could assume maintainance responsibilities of the landscaping. They already do have this responsibility at other landscaped sites throughout the State & 10th Ave. So. does fall under their jurisdiction.



Community Beautification Association

MAINTAINANCE CON'T:

B. The City of Great Falls Park Department, under contract with the Montana Highway Department, could perform the maintenance work.

C. A private landscaping contractor, under contract with the Montana Highway Department, could preform the maintenance work.

We of the Community Beautification Association have received many favorable comments and endorsements from citizens concerning our demonstration island at 25th Street. In addition to landscaping looking nice, it has a positive influence on:

(1) the marketing ability of the merchants,

(2) the channelizing of traffic (through visual contrast

(3) the deliniation of driveways (which will help in reducing access related accidents),

(4) the retention of positive control of public right-of-way, and

(5) many other less obvious, but important driver related characteristics.

The Community Beautification Association is, therefore, respectfully requesting that you give the above mentioned point of view every consideration and that you support the desires of the citizens of this community to beautify 10th Avenue South.

Sincerely,

Loy Ann P. Rembe

Loy Ann P. Rembe
President G. F. C. B. A.

cc; City Manager-Chris Cherches
Director of Highways-Ron Richards
City Commissioners
County Commissioners
State Hi-way Co missioners
City-County Planning Board
All TAC members
All PCC members

Community Beautification Association

APPENDIX G

REVIEW AND COMMENTS

APPENDIX G

REVIEW AND COMMENTS

This project was subject to review and comment at several stages of development. Technical review was provided by the Great Falls Technical Advisory Committee. Review on the beautification plan was provided by the Great Falls Community Beautification Association. Review on the access plan was done at a meeting with the Great Falls Chamber of Commerce, and by having the proposed access plan available for inspection by merchants along Tenth Avenue South.

In addition to these special reviews, media coverage included a number of newspaper articles and television news clips about the project, and a one-half hour television interview on the project. The Technical Advisory Committee meetings were open to the public, and several were well attended by people interested in the Tenth Avenue South Project.

At the conclusion of the preparation of the draft report, written comments were solicited. Technical Comments provided by the Great Falls City-County Planning Board, the Montana Department of Highways, and the Federal Highway Administration have been incorporated into the final text where applicable.

Written comments that were received from the public are reproduced in this appendix.

GREAT
FALLS AREA
CHAMBER OF COMMERCE

P.O. BOX 2127
926 CENTRAL AVENUE
GREAT FALLS, MONTANA 59403
(406) 761-4434

March 30, 1979

Montana Highway Department
Helena
Montana 59601

RE: Tenth Avenue South Improvement Plan
Draft Report submitted by Robert Peccia & Associates

Gentlemen:

It was a pleasure for the Planning and Traffic Committee of the Great Falls Area Chamber of Commerce to have cooperated with you on generating public input for the proposed Tenth Avenue South Improvement Plan. It is important to all of the parties that citizen participation contribute to making this plan the best, most acceptable, and most beneficial possible.

We concur with the Draft Report's recommendations in general, but express the following exceptions:

(a) The ramifications of the recommendation to move the 5th and 6th Street One-Way Couplet to 4th and 5th Streets need to be reexamined.

(b) There is strong local sentiment that more median beautification than is recommended by the consultant should be installed.

(c) Individual attention must be given to the closure of any curb cuts especially where assumptions have been made about the possibility of one or more businesses sharing a curb cut. The nature of certain businesses make such cooperative ventures incompatable. Special attention should be paid to internal circulation of businesses where traffic control systems are in place in order to separate entrance and exit traffic. How the proposed curb cuts interface with existing city ordinances in this matter also need additional examination.

We look forward to working more with you on the implimentation of a Tenth Avenue South Improvement Plan. This street is the most heavily traveled in Montana. It needs prompt attention to make it as safe and efficient as possible.

Respectfully submitted,

GREAT FALLS AREA CHAMBER OF COMMERCE

Roger W. Young
Executive Vice President

RWY/wg

FRONTIER DODGE, INC.

1017 - 10TH AVE. SO
GREAT FALLS, MONT
59401

761-6300

MARCH 30, 1979

CHAMBER OF COMMERCE
GREAT FALLS, MONTANA

DEAR SIRS,

FRONTIER DODGE, INC. CONTROLLING THE FULL FRONTAGE ON THE NORTHSIDE OF THE STREET BETWEEN 10TH AND 11TH STREETS ON 10TH AVE SOUTH GOES ON RECORD OPPOSING THE CONVERSION OF 10TH AVE SOUTH TO A SIX LANE HIGHWAY AND ALSO THE ELIMINATION OF THE SIX CURB CUTS NOW GIVING US ACCESS TO OUR PROPERTIES USED IN THE RETAIL BUSINESS OF NEW AND USED AUTOMOBILES AND SALE OF PARTS AND SERVICE.

IT WOULD BE IMPOSSIBLE FOR US TO REMAIN IN BUSINESS AND TO OFFER THE CONSUMER THE SERVICES THEY ARE AFTER BY THE ELIMINATION OF THE ABOVE MENTIONED CURB CUTS.

WE ALSO ASK THAT THE STATE OF MONTANA NOTIFY US IN WRITING BEFORE ANY ACTION IS TAKEN TO ELIMINATE ANY OF THE CURB CUTS.

SINCERELY,

ARTHUR O. SKIFTUN, VICE PRES.
FRONTIER DODGE, INC.

LEGAL DESCRIPTION OF PROPERTY:
LOTS 8,9,10,11,12,13,14 BLOCK 513.

AOS/MJB

MARCH 30, 1979

CHAMBER OF COMMERCE
GREAT FALLS, MONTANA

DEAR SIRS,

OTTO SHINE CAR WASH WISHES TO GO ON RECORD OPPOSING THE CONVERSION OF 10TH AVE SOUTH TO A SIX LANE HIGHWAY AND ALSO THE ELIMINATION OF ONE OF THE TWO CURB CUTS WE NOW HAVE.

IT IS IMPERATIVE THAT WE HAVE AN ENTRANCE AND AN EXIT IN ORDER THAT WE HAVE A CONTROLLED SAFE FLOW OF TRAFFIC. IT WOULD ALSO BE VERY HARD TO SHARE CURB CUTS WITH ANY OTHER BUSINESS IN OUR BLOCK AS THE NATURE OF OUR BUSINESS IS NOT COMPATIBLE WITH THEM.

WE ALSO ASK THAT OTTO SHINE OF GREAT FALLS BE NOTIFIED IN WRITING BEFORE ANY ACTION IS TAKEN TO ELIMINATE ANY CUTS.

SINCERELY,

ARTHUR O. SKIFTUN, PARTNER
OTTO SHINE OF GREAT FALLS

LEGAL DESCRIPTION OF PROPERTY:
LOTS 13 AND 14 IN BLOCK 514.

AOS/MJB

L. D. McGLYNN, M.D.
PHYSICIAN AND SURGEON
2517 7TH AVENUE S.
GREAT FALLS, MONTANA
OFFICE [illegible]

February 6, 1979

Peccia & Associates
Consulting Engineeers
#1 Last Chance Gulch
Helena, Montana 59601

Re: Public comment on Tenth Ave. South
Great Falls, Montana

Dear Sirs:

It is my understanding that your firm is the consulting engineer to advise Great Falls on what to do with Tenth Avenue South. I would like to suggest that a solid divider be placed on this street from one end to the other so traffic cannot cross except at intersections which have stop lights.

The desirable effects of this would be that a motorist driving down the street would only have to watch for traffic entering the street from the right and not for traffic entering from the left as now occurs.

Furthermore, any traffic entering from the left must cross at least two lanes and involve the third lane and often they cross all four lanes of traffic at great risk to themselves and the other people using the avenue.

As a precedent for this, I should like to cite the situation in the contiguous cities of Palo Alto, Menlo Park and Stanford, California where the main street running through all these towns is named El Camino Real (The Kings Highway). In those cities the street is completely divided except at intersections which have stop lights and traffic flows much more smoothly than in Great Falls.

Sincerely yours,

L. D. McGlynn, M.D.

LDM: rw

L.D. McGlynn, M.D.

APPEARANCE BEFORE TECHNICAL ADVISORY COMMITTEE
CIVIC CENTER GREAT FALLS, MONTANA

SUBJECT: CURB CUT ELIMINATION

PRESENTED BY R. W. SOLBERG, PRESIDENT BISON MOTOR CO.

GENTLEMEN:

IN 1954, THE OFFICERS OF BISON MOTOR CO. STARTED THE DEVELOPMENT OF WHAT MAY NOW BE CONSIDERED ONE OF THE MOST OUTSTANDING CAR AND TRUCK SALES AND SERVICE FACILITIES IN THE NORTHWEST. THE DEVELOPMENT BECAME NECESSARY BECAUSE OF CONGESTION, LACK OF PARKING SPACE, AND OUR DESIRE TO PROVIDE THE UTMOST IN CUSTOMER CONVENIENCE. ALL WERE SERIOUS PROBLEMS IN THE FORMER LOCATION AT 2ND ST. AND 2ND AVE. NORTH.

A VERY SUBSTANTIAL INVESTMENT WAS MADE IN THE ACQUISITION OF THE PROPERTY NECESSARY TO PROVIDE THE SPACE NEEDED TO ACCOMPLISH OUR OBJECTIVE. ADDITIONALLY, HUGE SUMS WERE EXPENDED FOR DEVELOPMENT; PAVING, FENCING, LIGHTING, ENGINEERING, DRAINING AND ERECTING BUILDINGS TO PROPERLY ACCOMODATE AN ADEQUATE FLOW OF CUSTOMER TRAFFIC AND THE DISPLAY AND STORAGE OF VEHICLES.

I MIGHT ADD THAT THIS WAS DONE ON THE BASIS OF EXPERT ENGINEERING ADVICE AND CONSULTATION AS AT THAT TIME THE WIDENING OF 10TH AVE. SOUTH WAS IN THE DEVELOPMENT STATES. IT WAS OUR DESIRE GO COMPLY IN ALL RESPECTS WITH THE DEMANDS OF THE PLAN FOR WIDENING THE AVENUE.

IT WAS THEN AND IS NOW, IN OUR OPINION, REASONABLE AND PRUDENT TO LIMIT THOSE 350 FEET OF PRIME 10TH AVE. SOUTH FRONTAGE INVOLVING LOTS 7, 7A, 8, 9A, 9B, & 10A TO TWO CURB CUTS.

EARLY IN THE 1960'S, THE COMPANY NEGOTIATED WITH THE ENTERPRISE CORPORATION FOR THE LEASE OF A BUILDING IT PLANNED TO CONSTRUCT ON PROPERTY OWNED AT 10TH AVE. SOUTH AT 5TH ST. ON LOTS 5 & 6, BLOCK 1, 15TH ADDITION. AFTER SATISFACTORILY NEGOTIATING A LEASE, THAT COMPANY CONSTRUCTED A SIZABLE BUILDING ON ITS PROPERTY. THE BUILDING, OCCUPIED IN 1966, HAS WORKED OUT IN A MOST SATISFACTORY MANNER AND ITS WEEKLY USE AS A CAR AND TRUCK SERVICE FACILITY, PARTS DEPARTMENT AND SALES CENTER HANDLES THE TRAFFIC IN A MOST EFFICIENT MANNER. IT IS INCONCEIVABLE THAT

THIS 150 FOOT FRONTAGE AREA COULD BE DEPRIVED OF ITS ONLY AVENUE CURB CUT. TO CONSIDER CHANNELING HEAVY TRUCK TRAFFIC THROUGH AN OFF AVENUE LANE INTO THE BUILDING SERVICE ENTRANCE IS BOTH IMPRACTICAL AND HIGHLY UNWORKABLE. VISUALIZE IF YOU WILL, THE TRAFFIC CONGESTION CREATED BY REQUIRING ALL VEHICLES TO TURN SOUTH ONTO 5TH ST. AND THEN MAKE AN IMMEDIATE LEFT TURN TO CROSS IN FRONT OF THE BUILDING TO GAIN ACCESS TO THE SERVICE ENTRANCE. NORTHBOUND TRAFFIC WAITING FOR THE LIGHT TO ENTER 10TH AVE. SOUTH WOULD BLOCK ALMOST ALL ATTEMPTS FOR ANY VOLUME OF VEHICLES TO CROSS OVER ONTO AN OFF AVENUE LANE. THE DESIGN OF THE SERVICE ENTRANCE BY ENGINEERS AND ARCHITECTS PAID PARTICULAR ATTENTION TO CLEARING 10TH AVE. EXPEDIENTLY, THUS THE 80 FOOT SET BACK OF THE BUILDING ENTRANCE ITSELF AS WELL AS DOUBLE LANES AND A 14 FOOT OVERHEAD DOOR.

AS RECENTLY AS DECEMBER 1978, BISON MOTOR CO. COMPLETED DEVELOPMENT OF ITS PROPERTY IN THE FIFTEENTH ADDITION, LOTS 1, 2, 3, & 4, BLOCK 1, MORE COMMONLY REFERRED TO AS THE PROPERTY BETWEEN 4TH AND 5TH STS. SOUTH. HERE AGAIN, THROUGH EXHAUSTIVE RESEARCH ON THE PART OF ENGINEERS, EVERY EFFORT WAS MADE TO COMPLY WITH RIGHT OF WAYS, ETC., WITH THE RESULT OF INSTALLING ONLY ONE CURB CUT IN AN AREA OF OVER 250 FRONT FEET ON 10TH AVE. SOUTH.

IN TOTAL, CUSTOMERS OF THIS FIRM HAVE ACCESS TO OUR FACILITIES FROM A GRAND TOTAL OF FOUR CURB CUTS IN OVER 800 FEET OF FRONTAL AREA ON 10TH AVE. SOUTH. SPECIFICALLY FROM WEST TO EAST, ONE CURB CUT INTO OUR NEWLY CONSTRUCTED LEASE AND SALES FACILITY IN THE 400 BLOCK. ONE INTO THE BUILDING LEASED FROM ENTERPRISE CORPORATION THROUGH WHICH AN AVERAGE OF 100 VEHICLES PER DAY ENTER INTO OUR SERVICE DEPARTMENT. PLUS AN ACCESS TO AND EXIT FROM OUR USED VEHICLE MERCHANDISING AREA AND STORAGE LOTS.

THE STATE OF MONTANA, THROUGH ITS PROPERTY CLASSIFICATION AND EVALUATION BRANCH, PLACE A GREAT DEAL OF EMPHASIS TAXWISE ON PROPERTY ADJOINING 10TH AVE. SOUTH. PROPERTIES ON 10TH AVE. ARE ASSESSED AT VALUES SIX TO TEN TIMES GREATER THAN SIMILAR LAND FRONTING ON OTHER STREETS. THIS WOULD SEEM TO SAY THAT BECAUSE OF 10TH AVE. TRAFFIC AND THE MERCHANTS ABILITY TO ATTRACT BUYERS OFF THE AVENUE THROUGH THE USE OF CURB CUTS, THE VALUE OF THE PROPERTY IS CONSIDERED TO BE MUCH GREATER.

THE HIGHER TAXES WITHOUT THE BENEFIT OF CURB CUTS IS CERTAINLY QUESTIONABLE.

TO SUMMARIZE, I MUST STATE THAT THIS COMPANY HAS THE MINIMUM NUMBER OF CURB CUTS IT CAN EXIST WITH. TO REDUCE THE CURRENT NUMBER WOULD SEVERELY LIMIT OUR ABILITY TO SERVE OUR CUSTOMERS AND THEREBY LIMIT OUR ABILITY TO MAINTAIN OUR CURRENT PAYROLL OF NEARLY 100 PERSONS.

THE "BOTTOM LINE" OF THIS STATEMENT IS THAT AN ENTERPRISE SUCH AS OURS INVOLVES CARS AND TRUCKS. WITHOUT INVOLVEMENT WITH VEHICLES THE SALES, PARTS, AND REPAIR ACTIVITIES OF THIS COMPANY WOULD NOT EXIST.....TO BE INVOLVED WITH VEHICLES WE MUST PROVIDE CUSTOMERS WITH CONVENIENT, EASY ACCESS TO OUR FACILITIES. THIS SIMPLY MEANS THAT WE MUST RETAIN OUR FOUR CURB CUTS TO GET THE WHEELS ONTO OUR PREMISES.

Ski's Western Motel
2420 10th Avenue South
Great Falls, Montana
March 20, 1979

City-County Planning Board
% Civic Center Building
Great Falls, Montana

Gnetlemen;

We, the undersigned, Rita L. & John B. Jaraczeski d/b/a Ski's Western Motel, located at 2420 10th Avenue South, submit this protest to the proposed elimination of curb cuts on 10th Ave. South.

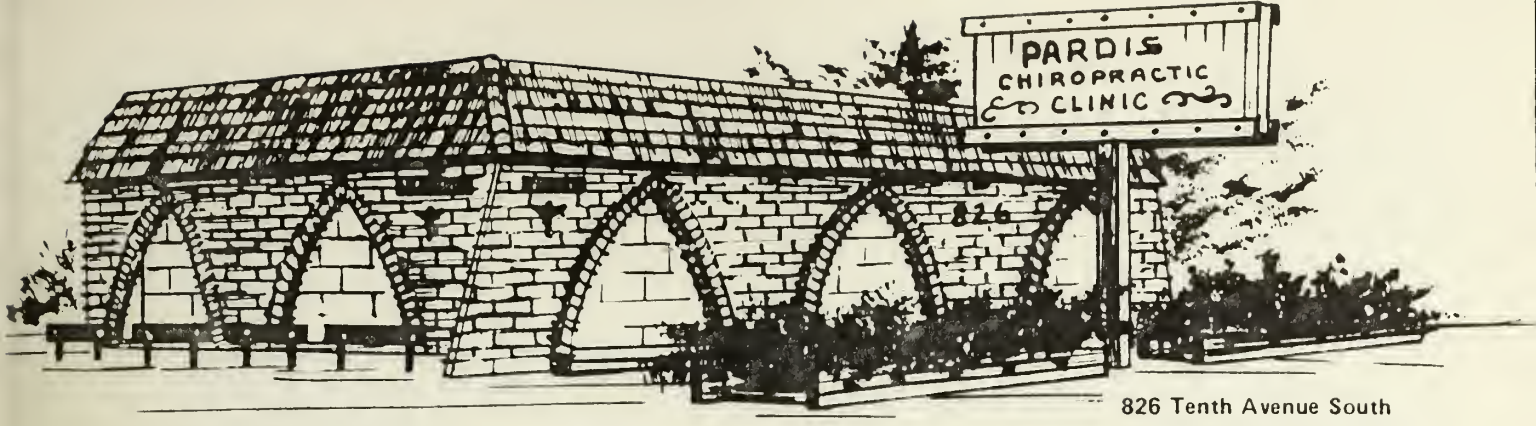
Due to the fact that our type of business depends entirely on highway travel, we feel that with the elimination of our curb entrance, a great inconvenience would be created towards our potential customers, thereby resulting in a financial loss to us.

Your consideration in this appeal will be appreciated.

Yours Very Truly,
SKI's WESTERN MOTEL

Rita L. Jaraczeski & John B. Jaraczeski
Owners

RLJ & JBJ:bjw



DR. WM. H. PARDIS, Chiropractor
DR. MICHAEL H. PARDIS, Chiropractor

PARDIS CHIROPRACTIC CLINIC, P.C.

826 Tenth Avenue South
Great Falls, Montana 59405
(406) 454-1381

March 2, 1979

Daily, Peccia & Associates
C/O Montana State Highway Department
Helena, Montana 59601

Re: Proposed changes on 10th Avenue South in Great Falls.

Dear Sirs:

I have read and reread all the newpaper articles and studied the maps on display at Eastside Bank. It is easy to agree with your objectives, but your avenues of approach are questioned.

Of course, my primary complaint is the apparent treatment my office will receive if you are allowed to cut down on the curb cuts. According to the charts at the Eastside Bank, my property, in lot 70 of your aerial photograph, would share a curb cut with my next door neighbor - Wendy's Hamburgers. Wendy's have built a raised flower bed on the property lines and it would appear next to impossible to share a curb cut. If my office were to lose its 10th Avenue South access, you might as well plan to buy my property, as access on 9th Street South would be next to impossible with people trying to use the same cut for ingress and egress. This would force traffic back onto 10th Avenue South frequently.

This is my formal protest concerning the curb cuts and plans for my property on 10th Avenue South. I surely hope the property owners do not have to form an association for protection with all the legal ramifications and delays such would cause.

Possible solution - make the outside lane on 10th Avenue South right turns only and traffic will have better ingress and egress to property fronting 10th Avenue South.

Respectfully,

WM. H. PARDIS, D.C.

WHP: gd

March 29, 1979

City-County Planning Board
City of Great Falls
P.O. Box 5012
Civic Center
Great Falls, Montana 59401

Gentlemen:

We own two lots located at 1512 and 1514 10th Avenue South, west of the Pizza Hut and east of Haggarty Motors Used Car lot. We viewed your proposed curb cuts at Eastside Bank and at the Chamber of Commerce. We feel that it would be much more beneficial to the Pizza Hut, ourselves, and all the motorists involved if the cut between our two buildings were eliminated instead of the other two curb cuts. Your proposal would result in many traffic accidents due to traffic being backed up onto Tenth Avenue South resulting from the cars slow rate of travel through this center area, which has been the situation for the three and one half years we have owned our buildings.

If you have any questions, please give us a call.

Sincerely,

Donald C. Seidel
Angeline F. Seidel
Owners of Creative Plastercraft
1514 10th Avenue South
Great Falls, Montana 59401

Midway Toyota

2516 7th Ave. South
GREAT FALLS, MONTANA 59405
(406) 453-6846

"WHERE SERVICE IS STANDARD EQUIPMENT"

March 16, 1979

City County Planning Board
Civic Center
Great Falls, Montana

Gentlemen:

Regarding the 10th Avenue South proposal, I would like to submit the following: My interest in this proposal is that I own the property at 3505 10th Avenue South, the Toyota Sales and Service facility, built in 1977.

Before I purchased the land to build the above facility I contacted the State Highway Department here in Great Falls to find out what their intentions were so far as their right of way was concerned. I was told that nothing would be done with that parcel as long as either one of us was alive. The bypass was their number one project and as far as the State of Montana was concerned, they would like to sell the property.

At that time I offered to purchase the land fronting my property, but was told the only way the State could sell would be at a public auction. Which of course would be a disaster to the property owners.

The State of Montana is considering removing some 200 curb openings out of approximately 300. I also understand that only some 32 Legal permits were applied for out of the 300 openings. I happen to be one of those few and feel we have a legal right to that curb opening, which is the only one on this property.

I have never as a property owner been notified of any meeting pertaining to this project and feel that I should be. Please send any further corespondence to 2516 7th Ave. South, Great Falls, Mont. 59405.

Sincerely

Art Wenzek

C C: Chamber of Commerce
Daily-Peccia & Associates
State Highway Dept.

COAST TO COAST STORES

Lance Swanson, Owner
~~721 Central Avenue~~
GREAT FALLS, MONTANA 59401
Phone: 761-4400

THE STORE WHERE YOUR DOLLAR WILL DO THE MOST

3-16 79

John Mooney
City County Planning Board
Civic Center Building
Great Falls, Mt.

Dear Mr. Mooney:

I am writing this because of the proposed elimination of curb cuts in front of our store on the south side of 10th Ave. So. between 11th & 12th streets.

We need these two curb cuts because they are our only entrance and exit from 10th Ave. So.

On many days it's almost ompossible for customers to reach our store from 11th St. because of traffic lined up on 11th trying to enter 10th Ave. from the Holiday Village.

Elimination of the two curb cuts would be fatal to our business.

Sincerely,

Lance Swanson

Coast-to-Coast Stores
(Central Organization),
Incorporated
National Headquarters

10801 Red Circle Drive
Minnetonka, MN 55343
612 935 1711

Mailing Address
P O. Box 80
Minneapolis, MN 55440

TOTAL HARDWARE Coast to Coast

J. B. Karels
President

March 27, 1979

Mr John Mooney
City County Planning Board
Civic Center Building
Great Falls, Montana 59401

Dear Mr Mooney

Lance Swanson, our Coast to Coast store owner in Great Falls, Montana has advised us of the pending plans to eliminate the curb cuts in front of his Coast to Coast Store located at 10th Avenue South in Great Falls.

We understand that Mr Swanson has written to you objecting to this plan and has provided rationale supporting his objection.

The purpose of this letter is to support Mr Swanson's request that you reconsider and leave the existing curb cut in front of his store which provides his customers with the only ingress to his parking lot.

While we understand your position and the problems involved with maintaining safe and efficient traffic flow, there is no way of measuring the resulting damage to Mr Swanson's business, and to Mr Gregoire's building as a retail site for future tenancy and rental income, if you choose to eliminate the curb cut in question.

Mr Swanson and his family have served the Great Falls market for over 25 years through their Coast to Coast Store. His first store was located downtown, but the deterioration of the Central Business District as a retail center forced him to locate his store adjacent to the Holiday Village Shopping Center.

Mr Gregoire owns the property where the store is located and formerly operated a filling station on that site. Mr Gregoire as the property owner razed the filling station and constructed the present building for Mr Swanson to occupy on a lease basis.

Here are two independent businessmen who have the major portion of their personal estates and their livelihoods threatened by the proposed closing of the only ingress/egress to their parking lot.

That property not being part of the Holiday Village Shopping Center does not have free flow of traffic from the rest of the shopping center parking lot. Closing the curb cut will inconvenience Mr Swanson's customers to the point where I believe it will change their shopping patterns and you could indeed dry up his clientele.

Hardware is a convenience commodity and consumers prefer to buy hardware where it is most convenient to park and find the merchandise they need. If you are a hardware store customer, you are familiar with this fact. The lack of easy access and convenient parking is essential to a good hardware store or for that matter any good retail location.

The small independent businessman of America is a vanishing breed. Government and big business continue to take their toll through new and devastating red tape and legislation. Messrs Gregoire and Swanson have a landlord and tenant/retailer business relationship the success of which is tied directly to easy access to the free parking they provide their customers at no cost to the taxpayer. I hope you can find an alternative to the closing of the only direct ingress/egress to the property.

Sincerely

Joe Karels
President

jr

cc: Lance Swanson
Bernie Gregoire

10TH AVENUE SOUTH SAFETY STUDY

THANK YOU FOR TAKING THE TIME TO REVIEW THE PROPOSED ACCESS (CURB CUT) CONTROL MAPS PREPARED AND FORWARDED BY PECCIA & ASSOCIATES, HELENA, MONTANA, AND DISPLAYED THROUGH THE COURTESY OF EASTSIDE BANK OF MONTANA.

YOU ARE REQUESTED TO PROVIDE YOUR COMMENTS/QUESTIONS ON THE GENERAL CONCEPT OF ACCESS CONTROL AND/OR SPECIFIC CURB CUTS. PLEASE PROVIDE YOUR COMMENTS BELOW. THANK YOU.

We at Blue Cross of Montana are very concerned with the proposed reduction of curb cuts from Tenth Avenue South into our property for the following reasons:

1. You are proposing reducing curb cuts into Blue Cross property from three to one which is simply not practical because there are five separate businesses operating from this property and this would also eliminate a substantial part of their parking area.

2. Your pictorial chart shows one curb cut into Louttits and one into Blue Cross of Montana which suggests that one could enter Louttits and exit the Blue Cross Plan curb cut. This is very misleading because the fact is that Louttits displays a solid line of trailers/campers along the property line between our respective properties, making this impossible.

3. Your pictorial chart also shows an exit from our property to 36th Street which, with your reduction of curb cuts from Tenth Avenue, would indicate that you are suggesting this as an entrance/exit alternate. This approximates Tenth Avenue South such that it would create a serious traffic hazard.

We recognize the need for certain modifications concerning traffic flow, etc., on Tenth Avenue South; however, we feel that the property owners fronting Tenth Avenue South should be contacted individually as was promised by the consulting firm involved before making any changes.

Sincerely,

Virgil E. Miller
President
Blue Cross of Montana

VEM:wpd

10TH AVENUE SOUTH SAFETY STUDY

THANK YOU FOR TAKING THE TIME TO REVIEW THE PROPOSED ACCESS (CURB CUT) CONTROL MAPS PREPARED AND FORWARDED BY PECCIA & ASSOCIATES, HELENA, MONTANA AND DISPLAYED THROUGH THE COURTESY OF EASTSIDE BANK OF MONTANA.

YOU ARE REQUESTED TO PROVIDE YOUR COMMENTS/QUESTIONS ON THE GENERAL CONCEPT OF ACCESS CONTROL AND/OR SPECIFIC CURB CUTS. PLEASE PROVIDE YOUR COMMENTS BELOW. THANK YOU.

NAME	REPRESENTING/ADDRESS	COMMENTS
Harold McCollum	McCollum Modern RV's, 4200 10th Ave. So.	

The property involved has 350' frontage on 10th Avenue South, currently with curb cuts at each end. The curb cut on the east end is utilized for exit only, which your map shows as eliminated. Believe analysis of this situation, because of no streets at either end of the property, should show the safety factor as superior as currently being utilized. Particularly so, since there is no break in the center median divider opposite from this cut, which means traffic exiting can only turn right and follow with the traffic, and cannot cross same.

10TH AVENUE SOUTH SAFETY STUDY

THANK YOU FOR TAKING THE TIME TO REVIEW THE PROPOSED ACCESS (CURB CUT) CONTROL MAPS PREPARED AND FORWARDED BY PECCIA & ASSOCIATES, HELENA, MONTANA AND DISPLAYED THROUGH THE COURTESY OF EASTSIDE BANK OF MONTANA.

YOU ARE REQUESTED TO PROVIDE YOUR COMMENTS/QUESTIONS ON THE GENERAL CONCEPT OF ACCESS CONTROL AND/OR SPECIFIC CURB CUTS. PLEASE PROVIDE YOUR COMMENTS BELOW. THANK YOU.

NAME	REPRESENTING/ADDRESS	COMMENTS

Gerald R Noble Noble Corner
716 10th Ave So

Gentlemen

I was advised that the proposed removal of curb cuts at the above mentioned property would be a detriment to our business approximately 2/3 of our business is Commercial business which have a number of large trucks. Under your proposal, it would be almost impossible for these units to get in and out. It would also be impossible for a tanker to drop product to us and continue to operate our business at the same time.

In our opinion we need the existing curb cuts in order to maintain profitably.

Gerald R Noble

The [illegible] PLAN [illegible] 10th" [illegible] - [illegible] [illegible]
COMMENTS BY L. B. BRISCOE MARCH 1, 1970

Chapter IV Street Lighting

The inadequacies of existing street lights from Warden Bridge to 20th Street and from 24th to 34th Street are recognized both as to location of the poles and to the types of luminaries. These should be discarded and new ones installed similar to those now in place on the remainder of the project. However, these lights are all part of a SID between the adjoining landowners and the Montana Power Company. As the location of the poles in the median strips was at the insistance of the Montana Power Company, coupled with a snow job on the City Council and was contrary to the wishes and recommendations of the Montana Highway Department, all expenses of removal and reinstallation should be borne by the SID. I strongly object to the use of highway user funds for this work.

Chapter V Drainage System

The inadequacies of the existing underground drainage system is recognized and a complete system is needed and should be installed. The recommendation for open ditch drainage as included in Figure 17 is ludicrous. Photographs 4 and 5 should be proof enough that the idea of open ditches in an area such as this project covers should be rejected.

No reference to the desireable minimum profile grade of .5% for effective longitudinal drainage is recognized. However, the existing profile, Figure 11 meets only four sections from Warden Bridge to 17th Street that do not meet this criteria, namely; from 2nd to 3rd, from 4th to 9th, from 24th to 25th and from 36th to 40th, and these sections can be corrected by gutter line adjustments. There appears to be no need to completely revamp the profile grades for the entire project to accomodate these minor revisitions.

Chapter VII Traffic Signal System

5 - Intersections Analysis

The recommendations to relocate the 5th and 6th Street couplet to 4th and 5th Streets will result in major disturbances to the existing traffic patterns for all of the 16 city blocks to the north. Such disturbance is not justified to merely accomodate the access to 10th Avenue South.

Referring to the proposed extension of the 25th and 26th couplet to 11th Ave. South. This extension was in place until extreme pressure from local groups resulted in the change to the present design. This opposition will probably not diminish in the future.

Chapter II - Geometric Design

Figure 17 -

The proposal for asphalt pavement surfacing of this project ignores the experiences encountered in Montana over the past years. An inspection of the condition of asphalt pavement of subject project, of Central Avenue West, of 1st and 2nd Avenues West of Park Drive, and of all other Streets and Avenues within the City of Great Falls maintained by the Highway Department will offer evidences of the sad experiences. The extreme limits of high and low temperatures, the large quantities of snow, the lack of vehicle weight and speed controls, the high traffic volumes, and the total ineffectiveness of local Highway Maintenance efforts make it mandatory that this project provide for Portland Cement Concrete surfacing. A 7" or 8" concrete slab with 4" to 6" open graded base course material would be much superior to the proposed sections shown in Figure 17. The existing medians could be used in place with minor adjustments to satisfy future turning movements as they become desireable. The limited pedestrian traffic could be accommodated with a 6' sidewalk, the extra feet available to widen the center traffic lane to 12 feet. The recommendation to continue four lanes east of 20th Street negates the need for total reconstruction east of 20th as contained in the proposal. With four lanes only six lanes a minimum of work is necessary for that portion of the project. Street lighting, signal modification, and drainage structures could be accomplished without major effort.

Chapter III

Table 1 - Cost Estimate

One important cost item appears to have been neglected and this is the right of way acquisition and damage. Several buildings will be affected by the widening to six lanes, elimination of driveways will result in loss of access and relocation of signs and signals certainly cannot be accomplished without dealing with landowners.

The proposal to defer parts of the work until after 1983 presumes that the NOW [illegible] will be started this year. The realistic view has to be that only minor work could begin before 1983, and major construction not before 1985. By that time the elapsed work schedule will require another consultant study which of course would embody a whole new approach to the remaining portions of the project.

Quoted below is a "Letter to the Editor" [illegible] 1973.

[illegible]

"[illegible] been completed after a period [illegible]. This study suggests [illegible] the improvements [illegible] thus both.

Would you believe that we paid [illegible] for the study? I could have told [illegible] authorities what improvements were necessary in two minutes and it would have cost a dime."

[illegible] R. [illegible], 3125 6th Ave. [illegible]

This letter tends to reflect my own attitude towards this report and its recommendations.

3/8/79 9:30 A.M.
Civic Center

10TH AVENUE SOUTH SAFETY STUDY

THANK YOU FOR TAKING THE TIME TO REVIEW THE PROPOSED ACCESS (CURB CUT) CONTROL MAPS PREPARED AND FORWARDED BY PECCIA & ASSOCIATES, HELENA, MONTANA AND DISPLAYED THROUGH THE COURTESY OF EASTSIDE BANK OF MONTANA.

YOU ARE REQUESTED TO PROVIDE YOUR COMMENTS/QUESTIONS ON THE GENERAL CONCEPT OF ACCESS CONTROL AND/OR SPECIFIC CURB CUTS. PLEASE PROVIDE YOUR COMMENTS BELOW. THANK YOU.

NAME	REPRESENTING/ADDRESS	COMMENTS
Peter Vladovkos	Gordon's Restaurant 616 - Tenth Ave. So	

The proposed change of curb cuts on our property would affect our entrances as well as create a bottle neck on 7th Street.

1) Must have more than one entrance because we are essentially 2 separate business units one roof.

NAME	REPRESENTING/ADDRESS	COMMENTS

Dr. C D Cory

Clifford D. Cory
2815-2817 10th Ave So.
On the corner of 29th ci
Next t

I have a 66 foot wide parking lot between my office building and the Conoco Service Station You presently have only one curb cut planned for the Conoco Station and none for my parking lot which would obviously create an impossible situation I have no legal right for my patrons to drive through the service station to get to my parking lot. If the owner of the service station should put a fence on his property like my parking lot would be inaccessable. The present curb cut is too narrow, making access dangerous as a car has to make too sharp a right angle turn. There also should be a curb cut out for cars parked in front of the building. Otherwise cars have to back out approximately 75 feet into the parking lot in order to gain access to 10th Ave South. This also is obviously a dangerous situation I would be more than happy to show & explain the situation at any time to anyone who would be willing to come to the property site

NAME	REPRESENTING/ADDRESS	COMMENTS
Richard S. Graft, II	Eastside Bank, 2215 10th Ave So	

The present proposal indicates the elimination of all curb cuts between 22nd and 23rd streets. This would eliminate the three curb cuts presently in existence.

Eastside Bank would like consideration to retain one curb cut. We presently have two parking lots located on the East and West sides of the building, respectively. We feel it essential to have one access directly off of 10th Avenue South into the West parking lot. Present plans would require Westbound traffic to turn right onto 22nd street and then make a quick right into the parking lot. This would impose a hardship since this maneuver would require a sharp turn. In addition, the grade into the parking lot is very steep. This would really present problems during the winter months due to the snow and ice that ordinarily accumulates. Because all the employees and many customers use this parking lot, the impact is substantial. In addition, because our automated teller machine is located in the foyer on the West side of the building, this parking lot is used extensively during all hours, especially when the bank is closed. Therefore, the inconvenience is further compounded at night and on weekends.

We have no objection to the present plan affecting the East parking lot. Customers will be able to conveniently use 23rd street to gain access to the parking lot.

We therefore request one curb cut for our West parking lot. We fully agree with the spirit of the effort to minimize curb cuts. However, because of the above reasons, we feel it essential to be granted this request. In addition, other blocks seem to have adequate access in light of particular needs without adversely affecting the businesses. We trust Eastside Bank will be given the same consideration.

10TH AVENUE SOUTH SAFETY STUDY

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NAME	REPRESENTING/ADDRESS	COMMENTS
Ed Novis	NOVCO 711 10th Avenue South	The one curb cut between Novco and Fuller Paint Co. is necessary for freight trucks loading and unloading. The removal would create a hardship to the operation of our business.
Al Strickland	Holiday Car Wash 1201 10th Avenue South	The removal of the corner curb cut would not only create a hardship to the operation of our business, it would also create a very dangerous traffic situation as the traffic entering and exiting on the remaining curb cut would be doing so completely blind. The entire view of oncoming and exiting traffic would be completely blocked by the building at 1209 10th Avenue South. Curb cuts have been assessed, etc. by city, are they going to give us a rebate? Also, traffic exiting from adjacent curb cut would have two blind sides.
Virginia B. Hallock	Private citizen 1506 23rd Ave. South	Leave 10th Avenue as is. Put through the highway proposed south of town and take the through traffic of 10th Ave. South.
Steve Hooper	Midas Muffler 909 10th Ave. South	The proposed curb cut for #49 is going to cause problems with my existing parking. The curb cut should remain on the southeast sector of the lot.
Tom Hermon	Sleep Center	The curb cut taken between 29th and 30th is in the wrong place on the south side of the street. Telepromter cable traffic is bigger than all the other merchants going east. The person who dreamed up all of these cuts didn't bother to find out the facts. If you guys want to become a one-horse town again, just keep it up and you'll make it quicker than you think. If you want to get pressure of 10th Ave. Sout

NAME	REPRESENTING/ADDRESS	COMMENTS
		make a bypass byway south of town or will you be going thru somebody's pasture in Rolling Hills ---
Bob Zadick	3040 10th Ave. South Safeway project	The curb cut proposal concern the above mentioned land is inadequate to promote business access to and from Safeway's parking lot. It will create a congested situation and traffic hazard by placing ingress and egress at the same point. The existing curb cut facilitates one point to enter from 10th and a second point to enter onto 10th.

This plan is totaly unacceptable. It also lends itself to providing a common entrance for the Flamingo and Safeway. This would prevent Safeway from keeping its parking lot exclusively for its own customers. We would have to eliminate the retaining wall between the Flamingo and Safeway.

In my opinion the reduction of curb cuts would hamper business volume as convience to customers is greatly reduced. This pipedream seems to be the most expensive attempt to revitalize the downtown area short of requiring only horse and buggy traffic on 10th. I hope the Chamber will support 20th century planning.

Al Verploegen	Taco John's	I don't think the curb cuts should be taken out. The business does need easy access or there won't be the traffic or the business.
Frank Maxwell	Burger King 1605 10th Ave. South	Is the access between Husky and B.K. going to be for both businesses. Or are you going to take one access to B.K.?
Don Seidel	Creative Plastercrafts 1514 10th Ave. South	I don't see how they can get by with only one off ramp between us and Pizza Hut, as now half the time you cannot get through between the two buildings. There now is one on the west side of our building and one between and one east of Pizza Hut.

Holiday Car Wash Marie Vaughn
Strickland (1201 - 10th Ave. SE.)

We would like it noted that we take exception to the fact that this was *supposed* to be a "safety study". If, in fact, safety was the prime purpose of this study the proposed curb cuts would not be located in blind entry-exit situations. Also it was stated (with reference to Frontier Lodge property) that entry and exit would be accomplished on side street only - the object is actually safer to enter the arterial by crossing one lane of traffic flow and then entering arterial at the [illegible] for exiting rather than directly using exit on the [illegible] the so called experts had better stand back and take a good look at the opportunity for accidents they have created. We don't think it requires any degree to see that the oftener the flow of traffic is disrupted for its crossings, the greater the chance for accident - wouldn't you say? The more convenient the entries and exits are placed curb cuts, the more you will have drivers who will not wait in line, but prefer to "jump" the curb and enter any old place. This observation is

based on a one visit observation (much less at the outside) . . . of the selling cars into Central West - the majority did not use the one-curb cut but drove over the sidewalk and curb - taking place which was convenient to the way they were pointed after backing up. Please do not insult our intelligence and try to tell us that these are isolated incidents at a single business. I don't think that human nature was a factor in your study. Unfortunately, we don't live in Utopia.
If the human factor was considered in all this you were using a different batch of humans than we have here in S. I.
I suppose, tho, that in dealing with the State as with any other governmental agency we must apply the old adage — "My mind is made up, don't confuse me with the facts!"

Just a few rambling thoughts from one disgruntled property owner - I'm sure the attorneys for the Plaintiffs will put it all much more ably (-!-)

A petition was circulated and submitted by the Great Falls Community Beautification Association. The petition was signed by 287 persons and contained the following clarifying statement:

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We, the undersigned, consider the landscaping and beautification of the median on 10th Avenue South, at 25th Street, in the City of Great Falls, by the Community Beautification Association of Great Falls, to be a significant and highly commendable endeavor to beautify 10th Avenue South, and we endorse and recommend further and additional landscaping and beautification efforts along the entirety of 10th Avenue South by the State of Montana and the City of Great Falls.

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